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PUBLIC HEALTH ASSESSMENT

YAKLISKE METALS AND RECLAMATION COMPANY
NEW MINGLEWOOD COUNTY, ZARIZONA

CERCLIS No. AZ00000000001

February 2005

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Prepared by:

U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation

Foreword

The Agency for Toxic Substances and Disease Registry (ATSDR) was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the Superfund law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency (EPA) and the individual states regulate the investigation and cleanup of the sites.

Since 1986, ATSDR has been required by law to conduct public health assessment activities at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the state, tribal, and territorial programs with which ATSDR has cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations—the structure may vary from site to site. Whatever the form of the public health assessment, the process is not considered complete until the public health issues at the site are addressed.

Exposure

As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, rather than collecting its own environmental sampling data, ATSDR reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data are needed.

The route of a contaminant's movement is called the exposure pathway, which has five elements: (1) a source of contamination, (2) an environmental media (such as, soil, water, or air), (3) a point of exposure, (4) a route of human exposure, and (5) a receptor population. The source is the place where the chemical or radioactive material was released. The environmental media transport the contaminants. The point of exposure is the place where persons come in contact with the contaminated media. The route of exposure (for example, ingestion, inhalation, or dermal contact) is the way the contaminant enters the body. The people actually exposed are called the receptor population.

Health Effects

If there are potential or completed exposure pathways where people have or could come into contact with hazardous substances, ATSDR scientists then evaluate whether these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children likely to be more sensitive and vulnerable to hazardous substances than adults. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high-risk groups within the community (such as the elderly, chronically ill, and people engaging in high-risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic, and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. ATSDR identifies those types of information gaps and documents public health actions needed in public health assessment documents.

Conclusions

If appropriate, this report presents conclusions about the public health threat, if any, posed by a site. Any health threats that have been determined for high-risk groups (such as children, the elderly, chronically ill people, and people engaging in high-risk practices) are summarized in the Conclusions section of the report. Recommendations are presented on how to stop or reduce exposure. The public health action plan describes how those recommendations will be implemented.

ATSDR is primarily an advisory agency, so its reports usually identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, exposure registries, surveillance studies or research on specific hazardous substances.

Community

ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals, and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. Comments received from the public are addressed in the final version of the report.

Comments

If, after reading this report, you have questions or comments, we encourage you to send them to us. Letters should be addressed as follows:

Attention: Aaron Borrelli
Manager, ATSDR Records Center
Agency for Toxic Substances and Disease Registry
1600 Clifton Rd. (E-60)
Atlanta, GA 30333

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List of Abbreviations

ATSDR	Agency for Toxic Substances and Disease Registry
CREG	cancer risk evaluation guide
CV	comparison value
EMEG	environmental media evaluation guide
EPA	U.S. Environmental Protection Agency
MCL	maximum contaminant level
MRL	minimal risk level
PCB	polychlorinated biphenyl
PHA	public health assessment
PHAP	Public Health Action Plan
ppb	parts per billion
ppm	parts per million
RfD	reference dose
SVOC	semi-volatile organic compound
TCE	trichloroethylene
VOC	volatile organic compound
YMR	Yakliske Metals and Reclamation Company
ZDHS	Zarizona Department of Health Services
ZEA	Zarizona Environmental Agency

Summary

This section should summarize the most important conclusions and recommendations of the PHA.

This section should be simple, clear, and concise, since it will be one of the most frequently read sections of the document.

Do not include any technical information, conclusions, or recommendations that are not addressed in the main body of the document.

Clearly present the main findings and the information supporting your conclusions.

Place conclusions in order of public health priority.

This public health assessment (PHA) reports the results of the Agency for Toxic Substances and Disease Registry's (ATSDR's) evaluation of past, present, and future exposures to environmental contamination associated with the Yakliske Metals and Reclamation Company (YMR) in New Minglewood County, Zarizona.

Between 1961 and 1993, YMR conducted various metals reclamation operations at the facility. The operations decreased substantially in the early 1980s, as residential developments were constructed around the facility. Currently, an animal research facility leases the YMR property. YMR's production processes released various contaminants into the environment. These releases decreased considerably in the early 1980s, when the demand for YMR's products dropped and the facility owners began focusing on environmental remediation. Local community members have recently asked whether their health was affected by contaminants from YMR.

ATSDR prepared this PHA to respond to community health concerns, to determine whether residents could contact harmful levels of environmental contamination, and to make recommendations to protect public health in the future. When preparing this PHA, ATSDR gathered and reviewed numerous reports, studies, and sampling data generated by several parties, including the U.S. Environmental Protection Agency (EPA), the Zarizona Department of Health Services (ZDHS), the Zarizona Environmental Agency (ZEA), YMR and its contractors, local community groups, universities, and private researchers. Overall, ATSDR believes the available data are sufficient to reach conclusions about several community concerns.

ATSDR concluded that some exposure situations at the YMR site pose ***public health hazards***. ATSDR's findings for the four environmental health issues of greatest concern are summarized below. Details about how ATSDR reached these conclusions are presented in this PHA.

- Off-site soil contamination has been found at four residential properties along YMR's southeastern property line. Past waste disposal practices contaminated surface soils on these properties with polychlorinated biphenyls (PCBs) at levels that could be harmful to children who live and play there. To prevent residents from contacting harmful levels of soil contamination, ATSDR has recommended that YMR, under EPA and ZEA oversight, promptly remove the contamination. Until these soils are removed, residents should limit potentially harmful exposures by avoiding gardening, playing in soils, and allowing pets to track outdoor soils into the house.

  Residents are not being exposed to on-site contamination because they cannot access the site property. Currently, workers do not frequently access areas that would result in frequent contact with contaminants. To prevent future harmful exposures, YMR should maintain site access restrictions, post signs warning of soil contamination, and develop a health and safety plan that informs workers of the location and potential hazards associated with contaminated areas.

- ATSDR discovered two private wells north of YMR that were contaminated with arsenic. The arsenic in those wells appears to be from past use of arsenic-containing pesticides on peach trees, rather than from YMR. Although the contamination was found soon enough that people likely have not been affected, continued use of the water containing arsenic at the levels found could increase a person's risk of developing certain cancers. For that reason, residences were connected to the municipal water supply.

  Past YMR operations contaminated the groundwater that is directly beneath the site. However, no one is using groundwater contaminated by YMR and YMR is taking measures to clean up the groundwater and to prevent any contaminants from migrating off site.

- It is safe for residents, including children, to contact the surface water and sediment in Haynes Creek, both upstream and downstream of YMR. The fence that surrounds the facility restricts access to the on-site portions of the creek.

  An incinerator began destroying small quantities of non-hazardous waste at YMR property in 1993. Though no information found suggests air emission rates are unusually elevated, no ambient air data are currently available to confirm this. ATSDR will reach its final conclusions about releases from the incinerator after reviewing results from an air sampling program that is currently under way. ATSDR will address this issue in a separate health consultation, expected to be released by the end of this calendar year.

I. Purpose and Health Issues

This section focuses the discussion for the rest of the PHA by identifying the main issues that will be addressed.

This section usually also includes a brief overview of community health concerns.

Explain what the PHA will and will not discuss.

Appendix C contains a fact sheet that describes the petition process.

In December 2003, the Agency for Toxic Substances and Disease Registry (ATSDR) received a petition from a community member to conduct a public health assessment (PHA) of the Yakliske Metals and Reclamation Company (YMR) site in Yakliske, Zarizona. Area residents expressed concern regarding past site activities and possible impacts on nearby neighborhoods. The major environmental health and community health concerns are:

- Has the quality of the water in private wells near YMR been affected by site contamination? Is it safe to drink the water?
- Are nearby residents or YMR workers exposed to harmful levels of surface soil contamination?
- Are people who use Haynes Creek for recreational and other purposes being exposed to harmful levels of chemicals in the surface water and sediment?
- Did past or do current air emissions from YMR, including from the incinerator, pose a health risk?

ATSDR conducted a comprehensive review of available environmental sampling data and other site information to address these major health concerns. Specifically, ATSDR examined the nature and extent of contamination and studied how people might have come in contact with site-related contaminants, both on and off site. ATSDR also addressed several other issues of concern to some community members, including exposure to lead-contaminated soil from sandblasting a water tower and to PCB-contaminated soil during gardening (see Section V).

The purpose of this report is to present the findings of the evaluation and recommended public health actions.

II. Background

II.A. Site Description and Operational History

In the background section, only include pertinent factual information that will provide the context for later discussions. Save your interpretations for later sections of the PHA.

Do not include information that is not directly relevant to the issues being discussed in the PHA (e.g., legal ramification for site owners).

As should be done throughout the PHA, clearly reference all statements of fact. Make it clear what are judgments and opinions.

Knowing the chronology of site operations can provide insight about possible environmental releases and exposures.

The YMR site is in Yakliske, New Minglewood County, Zarizona. Webb Gin House Road borders the site to the north. Several residential neighborhoods are around the perimeter of site. Haynes Creek flows across the southern portion of the site. Several smaller streams flow into Haynes Creek on and near the YMR property. In 1993, the current site lessee installed a secure fence along the perimeter of the site.

YMR started operations as a plating shop in 1961. Early operations involved sorting and storing metal products. The metal items processed on site included spent transformers and empty 55-gallon waste drums, some of which contained trace quantities of liquid and solid residue. One operation processed waste drums containing arsenic-laden dusts (EPA 2002). Operations occurred mostly in the facility's six buildings at the southeastern corner of the property (see Figure 1).

The primary plating operations, which included cleaning metal items prior to their salvage or reuse, were conducted in Building F. One of the rooms included a large sump to collect plating shop rinse water. The liquid wastes were discharged to unlined waste ponds (Ponds 1 and 2) west of the buildings. Periodically, water from these ponds was pumped to a spray field, where it was discharged to the ground. YMR dredged the ponds at least twice and disposed of the sludge at an off-site landfill. Other metal wastes generated at the facility were disposed in scrap piles west of the ponds (EPA 2002; ZEA 1995).

In addition to the metal processing operations, from 1968 through 1974, YMR painted radium on the dials of aircraft parts. These operations took place in one small room in Building E. After the contract for this work ended in 1975, YMR dismantled and disposed of the entire building, including associated waste materials, in a waste dump on the site (ZEA 1995). Records indicate that all waste materials in this area were removed and sent to an approved, off-site landfill (ABC 1992).

YMR ended its metal plating operations in 1993. Building F was demolished shortly thereafter, and building materials were disposed off site in an approved landfill (ABC 1992; Alpha 1994).

The industrial processes at YMR generated a wide range of liquid and solid wastes. Though the facility sent some wastes off site for treatment and disposal, most wastes were disposed in various on-site waste management units (ZEA 1995). These disposal areas included waste ponds, waste piles, junk piles, and a spray irrigation field. Sampling data and knowledge of past operating practices suggest that these on-site disposal areas likely contain materials contaminated with metals and selected organic compounds. Most of the on-site waste disposal areas are not clearly marked. Though a fence prevents residents from coming into contact with materials in on-site disposal areas, nothing prevents current workers from accessing these areas.

Describing site features, process operations, and waste handling practices provides information to support later discussions on environmental releases and possible exposure points.

Discuss past, current, and anticipated future activities.

Only one of YMR's former operations is known to have resulted in hazardous wastes disposed at off-site locations. From 1961 to 1975, YMR processed spent electrical transformers in an area at the southeastern corner of the facility known as the PCB Disposal Area (see Figure 1). As part of this operation, residual fluids were removed from spent transformers. These fluids contained polychlorinated biphenyls (PCBs), primarily in a mixture known as Aroclor 1254. YMR employees reportedly poured much of the residual transformer fluids directly onto soils. Although most disposals occurred in the southeast corner of the property, some employees reported pouring transformer fluids onto soils that are now part of residential properties along the facility property line. The property line was not clearly marked at the time PCB disposal occurred. The residences of concern were constructed in 1982. All PCB disposal at YMR ceased in 1975, when the facility stopped accepting spent transformers (EPA 2002).

Since 1993, YMR has been leasing its main buildings (Buildings A, B, and C) for animal research purposes. The current lessee operates an incinerator to manage animal carcasses and other non-hazardous wastes.

What Are PCBs?

PCBs, or polychlorinated biphenyls, are a group of 209 synthetic organic chemicals. The individual PCBs are known as congeners. PCBs were previously used in a wide range of products, such as electrical transformers and old fluorescent lighting fixtures. In 1977, EPA banned all domestic manufacture of PCBs due to growing evidence and concern that these chemicals build up in the environment—including in the tissues of animals and humans—and may cause harmful effects.

PCBs were commercially produced as mixtures of individual PCB congeners, and trade names were assigned to the separate mixtures. The most common trade names in the United States were a series of products named Aroclors (e.g., Aroclor 1016, Aroclor 1254, Aroclor 1260). The number following the "Aroclor" specifies the mixture of congeners in the commercial product. YMR primarily processed a mixture of PCBs known as Aroclor 1254.

II.B. Regulatory and Remedial History

Highlight key activities related to site investigations and site characterization (e.g., for Superfund sites, list the events leading to placement on EPA's National Priority list).

Starting in the 1980s, YMR conducted several site investigations and voluntary remediation actions, primarily to ensure that future users of the property are not exposed to harmful levels of contamination that might remain from past YMR activities. Further, environmental agencies also have been involved in addressing site-related contamination. Highlights in the regulatory and remedial history, organized by environmental medium, follow:

- *Groundwater.* After detecting groundwater contamination in the vicinity of the spray irrigation field (YMR 1983), YMR initiated two main actions to address the issue. First, YMR conducted quarterly monitoring of several groundwater wells to determine whether contaminants were migrating off-site (ABC Environmental 1992, 2002). Second, YMR constructed a pump-and-treat system to help prevent contaminant migration and to eventually restore groundwater quality (ABC

Environmental 1992, 2002). The Zarizona Environmental Agency (ZEA) is overseeing these activities.

There is no single approach for preparing this section of PHAs. Here, information is organized by medium. For other sites, different approaches for organizing information might make more sense.

The Zarizona Department of Health Services (ZDHS) has examined groundwater issues at off-site locations. Specifically, ZDHS conducted a well survey to identify and sample all private wells located downgradient from the site (ZDHS 2001, 2002). Two of the 12 private wells sampled contained elevated levels of some metals (primarily arsenic). The metals in the private well water are not believed to be associated with YMR. Refer to Section III.B.1 for further information on this issue.

Those activities associated with environmental releases, site investigations, and remedial actions are most pertinent.

- *Soil.* YMR has conducted several site investigations and focused clean-up efforts to address contaminated soils. Activities at on-site locations included extensive sampling in the 1980s, that led to the removal of two waste piles that contained building debris and other materials suspected of containing radioactive contamination. Wastes were sent to three off-site disposal areas in accordance with existing waste management regulations.

  In 2001, YMR contractors conducted a soil screening survey to identify off-site locations potentially affected by former waste disposal practices. The study found only one waste disposal area—the PCB Disposal Area—that extends off site (Melvin and Kelvin 2001). YMR recently completed a follow-up surface soil sampling study that found PCB-contaminated soils at four residential properties (YMR 2002). Section III.B.2 discusses this further.

For some sites— with longer, more detailed histories—presenting information in tabular format can be easier to read and serves as a nice supplement to text discussions.

- *Surface water and sediment.* There are no specific regulatory or remedial activities to note for Haynes Creek and its tributaries. However, several parties were awarded research funds to measure contamination levels in this watershed between the mid-1990s and 2002 (EPA 1998; Middle University 1998; Zarizona University 1998, 2002). Section III.B.3 of this PHA contains a summary of the results of those studies.

Do not include any information that is not directly relevant to the issues being discussed in the PHA. For other sites, it may not be necessary to include a Remedial and Regulatory History section in the PHA.

- *Air.* The animal research facility operates its incinerator under a general, facility-wide operating permit. The incinerator is exempt from medical waste and municipal waste combustion regulations because it burns less than 1 ton of waste per week, and less than 10% of the waste treated is classified as hospital waste or medical waste (EPA 1997). The lessee is required to keep records of the types of wastes burned, and ATSDR reviewed permit requirements and the facility's records to evaluate air quality issues for this site (see Section III.B.4 of this PHA).

II.C. ATSDR Involvement

In this section, briefly describe the chronology of ATSDR involvement at the site.

In December 2003, community members petitioned ATSDR to conduct a PHA of the YMR site. Area residents expressed concern about past site activities and possible impacts on nearby neighborhoods. To respond to the petition, ATSDR conducted an initial site scoping visit in June 2004. The purpose of the visit was to:

Present any conclusions or recommendations made as a result of past activities.

Depending on the level of community interest, the amount of activity and documentation in the PHA may vary, ranging from setting up information repositories to regular meetings and planning activities with the community.

- Determine whether information was available to allow an evaluation of the site.
- Meet with the petitioner, community members, and YMR employees to collect information they have about the site and their health concerns.
- Tour the site and surrounding areas to observe features and site conditions to determine possible exposure pathways.
- Meet with local and state health officials and representatives of EPA to collect available information.

ATSDR determined that a PHA was the appropriate course of action for this site, and the PHA process began in 2004. ATSDR's regional representative and community involvement staff have kept community members informed of ongoing progress by distributing newsletters and fact sheets. These materials were sent to more than 250 community members, public officials, and the media.

Additionally, ATSDR hosted a public meeting to gather information and help focus this PHA on the issues of greatest concern to the community. Through community input, ATSDR identified both the four issues of greatest concern to the community and several additional environmental health issues of interest. The meeting was announced in the local press, and more than 50 residents attended.

ATSDR established a local records repository. Copies of ATSDR's publications, including newsletters and fact sheets, for the YMR site can be viewed at the Yakliske Public Library. For more information on the repository and ATSDR's involvement with this site, community members may call Georgia Wilkes, Community Involvement Specialist, toll free at 1-888-42-ATSDR (or 1-888-422-8737), e-mail ATSDR at atsdr@cdc.gov, or visit the ATSDR Web site at www.atsdr.cdc.gov.

II.D. Land Use and Demographics

Document land use and natural resources at and near the site, describing the type and frequency of activities in the site vicinity.

Demographic information helps identify and define the size, characteristics, locations, and possible susceptibility of known populations related to the site.

The land near the YMR site is mixed residential and industrial use, with notable development and growth within the past 20 years. When YMR first began operations in 1961, the immediate area was largely undeveloped, with farms and woodlands surrounding the property. Since the 1980s, residential subdivisions have been built on all sides of the property, replacing most local farms. A daycare facility is east of the site. A residential farm cooperative for the elderly recently opened where a large dairy farm was previously located.

The 2000 Census data indicate that nearly 2,200 people reside within a 1-mile radius of the site (see Figure 2) (U.S. Bureau of the Census 2000). However, only four families are known to be affected by site contamination. Whether others have been affected by past air emissions is still under investigation.

This information will support discussions on exposure and health effects presented later in the PHA.

Both surface water and groundwater in the area are used for drinking water. On the basis of a recent well survey, ZDHS identified 12 wells within a ½-mile radius of the site, three of which are north/northwest, or downgradient, of the YMR northern boundary. The municipal supply, which serves most area residents, draws water from Lake Lanier, which is unaffected by contamination from YMR.

The main surface water feature in the area is Haynes Creek, which flows from east to west across the southern portion of YMR (see Figure 1). No one enters the portion of Haynes Creek that is on site. However, children play in the off-site portions of the creek. Flow in the creek is too low to support most recreational uses, such as swimming, wading, or fishing. In fact, EPA recently concluded that fish ingestion is not considered to be an important pathway for this site because there are no edible-sized fish in the creek (EPA 2002).

II.E. Quality Assurance and Control

It will not always be necessary to include this section. It would be important to include whenever we need to clarify why we rejected data and did not use it or respond to any concerns about the quality of the data used. Regardless of whether this section is included, data analysis should evaluate data quality, sampling techniques, data validation, and sampling representativeness.

In preparing this PHA, ATSDR reviewed and evaluated information provided in the referenced documents. Based on this evaluation, ATSDR determined that the quality of environmental data available for the YMR site is adequate for making public health decisions. ATSDR discusses any data limitations or data quality concerns in the discussions that follow.

III. Discussion

III.A. Methodology

In some cases (especially shorter documents), you may choose to keep the methodology section in the main text brief and provide more detailed information in an appendix.

As you prepare a PHA, you will make many choices about how to organize material within each section, how much detail to provide, whether to use a question-and-answer format in various sections, and so on.

It is important to clearly communicate that simply being exposed to a hazardous substance does not constitute a hazard. There are many factors that determine whether exposure to a contaminant would result in harmful health effects.

Include a concise summary of the screening analysis process, written in non-technical terms. More detailed descriptions and definitions can be included in an appendix.

ATSDR encourages health assessors to remain flexible while fulfilling the requirements.

Evaluating Exposures

ATSDR's public health assessments are driven by exposure, or contact. A primary role of ATSDR is to identify exposure pathways and characterize actual exposure situations. To accomplish this, ATSDR reviews site information about releases of contaminants from the site and evaluates how people might come in contact, or be exposed to, contaminated groundwater, soil, dust, surface water, sediment, or plants and animals. Figure 3 illustrates ATSDR's exposure evaluation process.

What is exposure?

The release of a chemical does not always result in exposure. Exposure may occur by breathing, eating, or drinking the substance or by skin (dermal) contact with the substance. If no one comes into contact with a contaminant then no exposure occurs, and thus no adverse health effects could occur.

When do health effects occur?

Exposure does not always result in adverse health effects. The type and severity of health effects that occur in an individual as the result of contact with a contaminant depend on the exposure concentration (how much); the frequency (how often) and duration of exposure (how long); the route or pathway (breathing, eating, drinking, or skin contact); and the multiplicity of exposure (combination of contaminants). Once exposure occurs, individual characteristics (e.g., age, sex, nutritional status, genetics, health status) and the toxicity characteristics of individual substances affect the degree of hazard.

For a public health hazard to exist, people must come in contact with contamination at levels high enough and for a long enough time to affect people's health. Exposure to radiation can occur by being near, and not necessarily contacting, the radioactive material. Although, a person must be close enough to the radioactive substance to be exposed to the radiation.

Determining which exposure situations and contaminants to evaluate

ATSDR scientists evaluate site-specific conditions to determine whether people are being exposed to site-related contaminants. If exposure is occurring or is possible, ATSDR considers whether environmental contamination is present at levels that might affect public health. ATSDR evaluates environmental contamination using available sampling data and, in some cases, modeling studies. ATSDR selects contaminants for further evaluation by comparing environmental contaminant concentrations with **health-based comparison values**. ATSDR develops comparison values from available scientific literature concerning exposure and health effects. Comparison values are derived for different environmental media. A comparison value is an estimated amount of a contaminant in the environment that is not expected to harm anyone, no matter how people contact the contaminant.

A comparison value is used by ATSDR to screen chemicals to determine which chemicals need additional evaluation.

Use the most appropriate site-specific approach, based on the knowledge, expectations, and information needs of your audience.

Consider including text boxes to highlight key points or to explain a key concept. Doing so will help the reader better understand ATSDR's assessment process and the scientific basis for the PHA conclusions.

On the other hand, if a contaminant is present in the environment at a level greater than the comparison value, contact with it does not necessarily mean that adverse health effects will occur. ATSDR comparison values are contaminant concentrations many times lower than levels at which no effects were observed in studies on experimental animals or in human epidemiologic studies. If contaminant concentrations are above comparison values, ATSDR further evaluates the contaminant and exposure. ATSDR does this by calculating exposure doses (see text box for definition) and comparing the doses to protective health guideline values, including ATSDR's minimal risk levels (MRLs) and EPA's reference doses (RfDs). Estimated exposure doses that are less than health guideline values are not considered to be of health concern.

> An exposure dose is the amount of chemical a person is exposed to over time.

If health guideline values are exceeded, ATSDR conducts a more in-depth analysis, studying the likelihood of adverse health effects under site-specific conditions and closely examining the scientific literature on the toxicity of the contaminant. Please see Appendix B for more details on the methods and assumptions ATSDR used to estimate human exposure doses and determine health effects.

III.B. Exposure Situations Evaluated at the YMR Site

The Discussion should include narratives that describe the exposures that may be of greatest concern. Also, it should clearly state those exposures that are not of public health concern.

ATSDR evaluated how people could be exposed to chemicals in the groundwater, soil, surface water, sediment, and air. Table 1 identifies the exposure pathways that have the potential for people to contact contamination and those that have been eliminated from further consideration. The four main environmental health questions identified by ATSDR are discussed in this section.

In addition, ATSDR evaluated several specific environmental health issues in response to community concerns. See Section V (Community Health Concerns) of this PHA for ATSDR's responses to these concerns.

1. Has the quality of the water in private wells near YMR been affected by site contamination? Is it safe to drink the water?

Concisely state the main finding and then explain the basis for your conclusion.

Do not use the ATSDR conclusion categories in the Discussion section. Opt for plain language that describes the degree of hazard, if any.

Groundwater beneath YMR is contaminated; however, the groundwater beneath the site is not used and the contamination has not migrated beyond the site boundary. Some private wells are northwest of the site in the direction of groundwater flow. Contaminants from the site have not reached those wells; however, two of the wells contain arsenic, which is believed to have entered the well water from local disposal of arsenic-containing pesticides that were once used to spray peach trees on the properties. These conclusions are based on hydrogeologic information, site environmental data, and the effectiveness of the on-going groundwater treatment system at the site.

Hydrogeologic conditions will influence how fast and in which direction groundwater contaminants might move, and ultimately if and how contaminants might reach people.

Consult with a subject matter expert when conducting certain technical evaluations.

Site Hydrogeology

Hydrogeologists recognize the aquifer in the Yakliske area as a thin surficial layer, below which lies fractured granite bedrock. Area hydrogeology is characterized as a weathered and fractured "metamorphic rock system." Depth to groundwater in the site vicinity ranges from 5 to 50 feet. Regional groundwater flow is generally in a northwesterly direction; however, local variations in flow direction have been documented. For example, most of the groundwater flow in the water table is toward and into surface streams. While some groundwater moves deeper into rock fractures, not all contaminants from YMR are expected to travel far. Any metal contaminants, for instance, would tend to quickly combine with existing geologic materials in the aquifer, likely reducing their effective movement to less than 100 meters from any source area. Solvents, on the other hand, such as trichloroethylene (TCE), would tend to sink, flow into the deeper fracture zone, and could migrate from the source area (USGS 1986; ABC Environmental 2002).

Do not assume that because municipal water is supplied to a residential area, residents are not using private wells.

Identify whether private wells are actively used for any household purpose, including drinking and showering, or perhaps just for outside use (e.g., gardening).

If other drinking water sources are being used, include a brief statement about the overall quality of that supply or direct the reader on how to obtain additional information about the safety of their drinking water.

Groundwater Use

Groundwater beneath the site has never been used as a drinking water source or for any other purpose. The buildings on the site are supplied with water from the safe municipal water supply. However, groundwater does serve as the drinking water source for some nearby residents. According to a ZDHS well survey, 12 private drinking water wells are within ½ mile north of the YMR site (ZDHS 2001). Three are north/northwest of the YMR site (see Figure 4).

Since 1940, the Yakliske Water District has provided drinking water to residential, commercial, and industrial customers throughout Yakliske. The source of the municipal water supply is Lake Lanier. The lake has not been affected by YMR (Faulkner 1990).

Since the early 1980s, the Yakliske Water District has monitored the water quality in Lake Lanier on a quarterly basis, near the drinking water intake line (Faulkner 2003). The water is analyzed for metals, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs). Barium, lead, and TCE were detected, and their maximum concentrations are well below ATSDR's comparison values and EPA's maximum contaminant levels (MCLs) (see Table 2). Therefore, the water from Lake Lanier is a safe drinking water source.

Summaries of environmental sampling data should focus on the most important aspects of the site or issue being evaluated.

Nature and Extent of Contamination

Groundwater quality at and near the site has been evaluated at various times since the early 1980s. Fairly extensive studies of groundwater reveal that contaminants associated with past site operations have been detected in on-site monitoring wells but have not migrated to off-site areas. Nearby private drinking water supply wells that

Focus on describing whether site contaminants are reaching people and exposure point data.

were tested in response to community health concerns contained elevated levels of some metals, though the metals are not believed to be associated with YMR. An overview of sampling results follows.

On-site Groundwater

A general discussion of the nature, magnitude, and location of on-site contamination is often helpful in demonstrating whether groundwater conditions have been adequately characterized and in evaluating potential off-site migration of contaminants.

In 1982, YMR installed four monitoring wells in the vicinity of the spray irrigation field (see Figure 4). At the time, the primary concern was the movement of contaminants from the spray field water into the groundwater, with possible discharge of contaminated groundwater to nearby Haynes Creek. The wells were sampled for VOCs, SVOCs, pesticides, PCBs, and metals. Initial testing revealed concentrations of TCE and some metals above ATSDR comparison values, but in localized areas (YMR 1983).

In 1990, the site owner installed additional monitoring wells to further characterize groundwater conditions across the site and to evaluate whether off-site areas could be threatened. Monitoring wells were installed up and downgradient of known or suspected source areas, such as the waste ponds and past dumping areas. From 1990 to the present, these wells have been sampled quarterly for VOCs, SVOCs, pesticides, PCBs, and metals. TCE, trace amounts of vinyl chloride, and some metals were detected in the groundwater at and near the scrap pile and waste ponds. YMR is pumping and treating the contaminated water to contain the small TCE plume beneath the site and to restore groundwater quality. Site monitoring wells continue to be sampled on a quarterly basis (ABC Environmental 1992, 2002). The treatment appears to be effective because site contaminants have not been found beyond the YMR property.

Private Drinking Wells

ZDHS sampled the 12 private wells within a ½ mile north of YMR for a full suite of VOCs, SVOCs, and metals. No VOCs or SVOCs were detected in any of the wells. Subsequently, ZDHS conducted quarterly sampling for metals only, focusing on wells north of the YMR site. This sampling revealed metal concentrations comparable to earlier findings (ZDHS 2002).

If detected contamination is not believed to be site-related, you should state so. In this case, ATSDR still evaluates the exposure to address specific community health concerns.

Sampling results showed elevated arsenic levels (up to 87 parts per billion [ppb]) in two of the sampled wells (see Table 3) (ZDHS 2002). Background levels of arsenic in groundwater in this part of Zarizona typically average about 1–2 ppb (ATSDR 2000a). All other detected metals were at concentrations below ATSDR comparison values. As a measure to reduce further exposures, ZDHS recommended that the two well owners immediately begin using bottled water for drinking and cooking purposes. These residences have since been connected to the municipal water supply.

The levels of arsenic in the well water were less than arsenic found on the site. Additionally, the hydrogeology and the pH of the groundwater limit the spread of arsenic. These facts, coupled with the local disposal of arsenic-containing pesticides, suggest the arsenic did not come from YMR. Nonetheless, to address the health

While detailed analysis of source attribution is not the purpose of ATSDR's public health assessment process, an explanation such as the one here can help answer community questions.

concerns of residents about the quality of their drinking water, ATSDR evaluated exposure to the arsenic.

> ATSDR believes that the arsenic contamination in the private drinking water wells could be the result of past disposal of arsenical pesticides into a dry well that has since been filled. There was a large peach farm in the area in the 1950s, which used arsenical pesticides to control insects. The farm closed in 1961, and the land was sold to a developer. Before homes were built, the entire area was covered with 1 foot of clean fill. Sampling occurred before homes were occupied. There was no residual arsenic contamination in the soil.

This section describes your evaluation of possible hazards. This requires integrating the exposure and health effects data that have been identified throughout the public health assessment process.

Public Health Implications

<u>On-site Groundwater</u>

Because groundwater beneath the site is not used for drinking water or any other purposes, no one is exposed to the contamination. The groundwater treatment system is effective in preventing migration of contaminants and restoring groundwater quality. Therefore, future exposure to site-related contamination in groundwater is unlikely. No one is expected to be harmed by the contaminants in the groundwater.

Clearly explain rationale for eliminated pathways.

<u>Private Drinking Wells</u>

The PHA should clearly state all assumptions used in your evaluation to select substance concentrations, dose estimates, etc.

Although unrelated to the site, arsenic was detected in two private wells north of YMR at concentrations up to 87 ppb. Of the wells sampled, WV-001 consistently had the highest levels. ATSDR evaluated both acute (short-term) exposure and chronic (long-term) exposure to the arsenic in the drinking water. For the short-term exposure, ATSDR assumed that an adult, weighing 70 kilogram (about 154 pounds), consumed two liters of water containing 87 ppb arsenic each day. For a child, ATSDR assumed that a 10-kilogram child (about 22 pounds) drank one liter of the contaminated water each day. Neither adults nor children would have had high enough exposures to result in noncancer health effects.

Do not present a mini-toxicological profile with information that has little relevance to the site or exposure situation being discussed. Instead, include more in-depth toxicologic evaluations and dose calculations in an appendix, as determined by the information needs of your audience.

Because the arsenic-containing pesticides (the suspected arsenic source) were used in the area before the homes were built, ATSDR assumed the well water was contaminated with arsenic from the time people began using the well water. Data collected over the last few years suggest that arsenic levels in the well water varied with seasons and other geologic conditions. The average level of arsenic over the years that data are available was 54 ppb. The average level is appropriate to use to evaluate long-term exposure.

Estimated chronic arsenic doses in children and adults approach levels at which observable effects have been reported in *human* studies. Therefore, drinking water from these wells could conceivably cause harmful health effects. Appendix B describes in greater detail the methods and assumptions ATSDR used to estimate human exposure doses and determine health effects from ingestion of arsenic in private wells. Appendix C contains a ToxFAQ for arsenic.

Because of uncertainties regarding the behavior of arsenic at low doses and the consistent detections of arsenic in the tested wells, prudent public health practice called for reducing exposures by limiting the ingestion of water from these wells. ZDHS informed residents that they should use bottled water until safe municipal water became available. ATSDR worked with ZDHS to permanently connect residences to the municipal water supply. See Section V (Community Health Concerns) for additional discussion related to the specific health concerns of some private well users.

2. Are nearby residents or YMR workers exposed to harmful levels of surface soil contamination?

Past waste disposal practices at YMR have left surface soil contamination at multiple on-site areas and at four off-site residences. The on-site contamination is not a public health hazard to residents because they cannot access site property. It is not a health hazard to workers because they do not frequently come into contact with the affected areas. To prevent future harmful exposures, YMR should maintain site access restrictions, post signs warning of soil contamination, and develop a health and safety plan that informs the current workers of the location and potential hazards associated with contaminated areas.

Four residential properties along YMR's southeastern property line have site-related contamination in their yards. Past waste disposal practices contaminated surface soils at these homes with PCBs at levels that could be harmful to children who live and play there. YMR should remove surface soils from these four homes to eliminate this health hazard and ensure that no residual PCB contamination remains in the deeper soils. Until these soils are removed, residents should limit potentially harmful exposures by avoiding gardening, playing in soils, and allowing pets to track outdoor soils into the house. Note that PCB levels in all other yards that were tested were well below levels of health concern.

Exposure to On-site Surface Soils

The YMR property includes waste disposal areas, such as waste ponds, waste piles, junk piles, and a spray irrigation field. Surface soils at these areas have been found to contain elevated levels of numerous metals, primarily arsenic[1] and mercury, and selected organic compounds. The presence of these wastes on site does not pose a hazard to residents, because residents cannot access site property. Provided YMR maintains effective site access restrictions, the on-site surface soil contamination will continue to pose no health hazard to residents.

[1] Even though soil at YMR is contaminated with arsenic, ATSDR does not believe that YMR is the source of the arsenic contamination found in the private wells. Please see the groundwater discussion for additional details.

ATSDR's mandate does not include the health of workers, as this falls under the purview of agencies such as the Occupational Safety and Health Administration (OSHA). However, ATSDR has limited authority to examine worker exposures related to the environmental releases under study (e.g., worker exposure to contaminated groundwater via the drinking water supply or incidental contact with contaminated soils). Workers could also bring contaminated materials home on their clothes.

Workers at the animal research facility and contractors, such as maintenance and landscape workers, do have access to the site. The animal research employees primarily work indoors and not at any of the waste disposal areas. Therefore, their exposure to surface soils at the waste disposal areas thus far has been limited. Maintenance and landscape workers also have limited exposure to waste disposal areas. However, potentially harmful exposures could occur in the future because several waste disposal areas are not clearly marked, workers have unlimited access to these areas, and many workers are not informed of the potential hazards posed by these areas. YMR can prevent such harmful exposures from occurring by posting warning signs at the contaminated areas and by developing and implementing a site health and safety plan. Such a plan should inform all site workers (regardless of their employer) where elevated levels of contaminants have been detected on site and what activities should be avoided in those areas until cleanup has occurred.

Community members have also expressed concern about possible radiation exposures associated with materials disposed in waste piles. This issue is addressed in Section V (Community Health Concerns).

Exposure to Off-site Surface Soils

In 2001, YMR contractors conducted a soil screening survey to identify off-site locations potentially affected by former waste disposal practices. The study found only one waste disposal area—the PCB Disposal Area—that extends to off-site locations (Melvin and Kelvin 2001). The contamination occurred because the site boundary line was not well-defined in the past, and disposal extended to those areas. YMR recently completed a follow-up surface soil sampling study to characterize the nature and extent of PCB contamination in this area (YMR 2002). In this study, YMR collected composite surface soil samples from 16 on-site locations and 12 off-site locations (see Figure 5). Surface soils, in this study, were considered to be the top inch of soil. All soil samples were analyzed using appropriate and highly sensitive laboratory methods for Aroclor 1254, which is the mixture of PCBs that most commonly remained in the spent transformers that YMR processed.

Provide a brief narrative summarizing the available environmental sampling data. The text may include a discussion of trends in the data. The discussion of trends can include descriptions of spatial distribution, "hot spots," or concentration changes over time.

Nature and Extent of Contamination

The off-site surface soil sampling results characterize PCB levels to which residents might be exposed. In the 2002 sampling study, each off-site sample was a composite of surface soils taken from 20 different locations at a single property. These composite samples were taken next to fence posts, in gardens and flower beds, and next to the foundations of the houses to increase the possibility of detecting any possible subsurface contamination that may have been brought to the surface during digging or construction activities. Thus, the sampling program was rather extensive in scope, and every off-site sampling result is believed to present a reliable measure of average soil contamination levels at a given home. Further, to address a community concern, sampling was also conducted in the Early Learning Daycare Center's play areas, even though the daycare is not adjacent to the PCB Disposal Area.

As Figure 5 indicates, PCB levels in off-site surface soils clearly varied from one property to the next—only four properties had detectable levels of PCBs, while the other properties tested, including the daycare, had no traces of PCBs. The spatial variations in PCB levels suggest that transformer fluids were previously poured onto surface soils that are now part of four residential properties. At these four properties, Aroclor 1254 concentrations in composite samples were 27 parts per million (ppm), 30 ppm, 30 ppm, and 80 ppm. These concentrations all exceed health-based comparison values for Aroclor 1254. For that reason, PCBs were selected for further evaluation.

Public Health Implications

Present the findings of your more in-depth evaluation and outline the information you used to draw your conclusions.

ATSDR estimated the amounts of Aroclor 1254 that residents of the four households might realistically ingest, based on the environmental sampling data and information on soil ingestion rates. Appendix B presents the equations and assumptions used to estimate exposure doses and Appendix C contains a ToxFAQ for PCBs. Exposure doses for children were found to be 20 times higher than those for adults. This difference results from children's higher soil ingestion rate and lower body weight. In other words, children ingest far greater amounts of soil in relation to their body weight than do adults. ATSDR compared the estimated exposure doses—for both children and adults—to findings from epidemiologic and toxicologic studies that examined harmful effects of exposure to Aroclor 1254.

ATSDR concludes that *adult residents* of the contaminated properties likely will not experience harmful health effects from ingesting soils because their estimated exposure levels are considerably lower than levels found to be associated with adverse effects in humans and laboratory animals. *Children*, on the other hand, who contact contaminated areas have estimated exposure doses comparable to those that have caused subtle immunological and neurobehavioral problems in laboratory animals. Further, while the most likely route of exposure to PCBs in the soil would have been through incidental ingestion, some absorption through the skin might also occur, although, to a lesser extent than would be expected orally. Therefore, children's exposure to PCB-contaminated surface soils at the four residential properties along YMR's southeastern property is considered a potential health concern. Appendix B discusses in detail the basis for these conclusions, as well as associated uncertainties.

The public health hazard associated with off-site soil contamination has existed for children residing in the four homes since 1982, and will continue until the contaminated soils are removed. This hazard is limited entirely to four residential properties; neighboring properties and other properties in the area do not contain harmful levels of soil contamination. For the four affected properties only, ATSDR recommends that YMR promptly remove contaminated soils from the front and back yards, under EPA and ZEA oversight. Until these soils are removed, residents should limit potentially harmful exposures by avoiding gardening, playing in soils, and allowing pets to track outdoor soils into the house. ATSDR has communicated these and other exposure reduction measures directly to the property owners.

Identify any data gaps and recommend sampling for critical data gaps that need to be filled before a conclusion can be drawn.

Subsurface soil samples have not been collected and analyzed for PCBs. Exposure to subsurface soils is less likely to occur than exposure to the surface soils. However, if residents dig holes for gardens, fences, foundations, or for other reasons, people will have the potential to be exposed to the subsurface soil. To address the possibility of subsurface soil contamination, YMR should conduct confirmation sampling during its soil removal project to ensure that all PCB contaminated soils are removed from the four properties of concern, including contamination at depth.

3. Are people who use Haynes Creek for recreational and other purposes being exposed to harmful levels of chemicals in the surface water and sediment?

Use plain language where possible to describe your evaluation.

It is safe to contact the surface water and sediment in Haynes Creek, upstream and downstream of YMR. None of the off-site surface water and sediment samples contained harmful levels of chemicals, even for children playing in the creek. The fence that surrounds the facility restricts access to the on-site portions of the creek; therefore, on-site contamination in the creek is also not a health hazard.

Hydrology

The main surface water feature in the area is Haynes Creek, which flows from east to west across the southern portion of YMR. Most runoff from the site flows directly into the creek. The headwaters of Haynes Creek are located less than 2 miles upstream from YMR. Some runoff from YMR also flows into two small ephemeral tributaries of Haynes Creek; these tributaries flow into Haynes Creek at the western edge of the facility. Haynes Creek is a perennial stream; only under extreme drought conditions has the stream become dry (EPA 1998).

Haynes Creek Use

There is no evidence of anyone accessing Haynes Creek where it flows on facility property. However, the off-site portions of the creek are accessible to neighborhood children, who are known to play in and around the creek. The flow and water depth in Haynes Creek are both too low to support recreational activities, such as boating, swimming, and fishing. Therefore, the greatest potential for exposure exists for children who periodically come in contact with creek water and sediment while playing and exploring in the area.

Nature and Extent of Contamination

Describe the limitations, quality, and usefulness of the data.

Surface Water

Three surface water sampling investigations have been conducted by local universities and EPA:

- In May 1998, a consultant with Middle University collected four surface water samples from two upstream and two downstream locations and analyzed the samples for pesticides and metals (Middle University 1998).

- In June 1998, during a site investigation, EPA collected 10 surface water samples from two upstream locations, six on-site locations, and two downstream locations. The samples were analyzed for metals, VOCs, and SVOCs (EPA 1998).

- From May 2001 to April 2002, researchers from Zarizona University collected monthly surface water samples from three locations in Haynes Creek: one upstream of YMR, one near a former process outfall on facility property, and the other downstream from the facility. The samples were analyzed for metals only (Zarizona University 2002).

Surface water samples were taken from Haynes Creek in the locations shown on Figure 6. All samples were collected, preserved, and analyzed in accordance with standard EPA protocol.

<u>Sediment</u>

Several sediment sampling investigations have been conducted by local universities and EPA:

- In August 1995, a student at Zarizona University collected three sediment samples from one upstream and two downstream locations. The samples were analyzed for VOCs, SVOCs, and metals (Zarizona University 1998).

- In May 1998, a consultant collected four sediment samples from two upstream and two downstream locations and analyzed the samples for pesticides and metals (Middle University 1998).

- In June 1998, EPA conducted a site investigation of the YMR site and collected 10 sediment samples from two upstream locations, six on-site locations, and two downstream locations. The samples were analyzed for metals, VOCs, and SVOCs (EPA 1998).

- In April 2002, researchers from Zarizona University collected sediment samples at three locations in Haynes Creek: one upstream of YMR, one near a former process outfall on facility property, and one downstream from YMR. The samples were analyzed for metals only (Zarizona University 2002).

Sediment samples were taken from Haynes Creek in the locations shown on Figure 6. All samples were collected, preserved, and analyzed in accordance with standard EPA protocols. However, the 1995 data from Zarizona University did not undergo a formal validation process.

Present the findings of your screening analysis in the Discussion section

Remind readers that the comparison values are not indicators of illness or harm. They are a first step in assessing and understanding potential harmful effects posed by exposure to site contaminants.

Public Health Implications

Surface Water

As Table 4 shows, the detected concentrations in the surface water were all safely lower than comparison values derived to assess *drinking water* scenarios. As stated earlier, comparison values reflect concentrations that are much lower than those that have been observed to cause adverse health effects. Therefore, ATSDR concludes that contact with Haynes Creek surface water does not present a public health concern.

Using drinking water comparison values to evaluate incidental exposures during swimming or other recreational activities is a protective approach.

Sediment

As shown in Table 5, six metals and four volatile organics were detected in the sediment samples. Arsenic was detected above its cancer screening value (the cancer risk evaluation guide, or CREG), but below the chronic noncancer screening value (the environmental media evaluation guide, or EMEG), and mercury was detected above its comparison value in one sample. All other contaminants were found at levels safely below comparison values. Following is ATSDR's review of the health implications of contacting the trace amounts of arsenic and mercury in Haynes Creek sediments:

Arsenic. Given the nature of the creek and purported use, contact with Haynes Creek sediment is minimal and exposure to detected arsenic concentrations (up to 5 ppm) is not expected to result in any adverse health effects, even for children playing in the creek. The average concentration (0.4 ppm), which is more representative of what a person might be exposed to over time, is below the CREG. Also, arsenic in sediment is not expected to be very "bioavailable," meaning that much (generally up to 80%) of the arsenic would likely pass through the body and not be absorbed (ATSDR 2000a). Lastly, as a point of reference, the CREG is lower than the average amount of arsenic found naturally in the earth's crust (2 ppm; ATSDR 2000a).

Mercury. The sediment samples showed an area of elevated mercury contamination near the process outfall; however, there is no evidence of mercury migration, based on the upstream and downstream results (EPA 1998; Middle University 1998; Zarizona University 2002). No one is accessing the on-site portions of Haynes Creek and the off-site concentrations are all below the comparison value. Therefore, ATSDR does not expect that people, including children playing in the creek, would be exposed to harmful levels of mercury in Haynes Creek sediments.

For the reasons cited, ATSDR concludes that the contamination in Haynes Creek does not pose a health hazard to children who periodically play in the area.

4. *Did past or do current air emissions from YMR, including from the incinerator, pose a health risk?*

Between 1993 and the present, the lessee of YMR's property has incinerated relatively small quantities of non-hazardous waste on site. Several records suggest that the air emission rates from the incinerator are not unusually elevated, and a monitoring program is currently being conducted to determine if air emissions from the incinerator cause potentially unhealthy levels of air pollution. ATSDR will review these monitoring data as soon as they become available and issue a brief health consultation that comments on the measured levels of air pollution.

Some residents have expressed concern about air emissions from YMR's past industrial operations. All available site reports indicate that YMR phased out its major operations as homes were being constructed around the site. Therefore, residents who moved into the homes that surround YMR had minimal, if any, exposure to contaminants that YMR released while its operations were greatest.

In 1993, YMR built two medical waste incinerators for the animal research company that leases the property. The incinerators are used to destroy animal carcasses and other non-hazardous wastes, such as bedding, latex gloves, and laboratory materials. No infectious or biological agents are used during the animal research. Only one incinerator remains in operation; the other incinerator was closed and dismantled in 1998. The lessee is not allowed to burn more than 1 ton of waste per week. According to the lessee's waste management records, the incinerator burns 300 pounds of waste per week on average. The lessee disposes of all incinerator ash in an off-site landfill.

Neither EPA nor the state has detailed information on air emissions from the incinerators, leaving ATSDR with no quantitative basis for making conclusions about this pathway. However, some insights about the incinerator operation provide comfort that unusually elevated air emissions have not occurred. First, the incinerator treats a relatively small amount of waste—an amount much smaller than that which environmental agencies choose to regulate. Second, the incinerator does not treat hazardous waste.

While these observations provide some reassurance that air emissions from the incinerators are not unusually elevated, ATSDR notes that these observations provide no quantitative insight on potential air exposures to contaminants from the incinerator. In response to growing community concerns about the incinerator operations, the lessee at YMR has hired a contractor to implement a VOC and particulate matter (PM10) monitoring program to measure ambient air levels at five monitoring locations. In addition, quarterly samples will be analyzed for dioxins, furans, SVOCs, and metals.

ATSDR reviewed the sampling plan and concluded that it should provide the information needed to determine whether exposures to harmful levels of substances are occurring. Monitoring stations were fully operational about a month prior to the release of this health assessment. ATSDR will make its final conclusion on air emissions from the incinerator within 3 months of receiving the validated ambient air monitoring data.

Use available information to present the community with as much perspective as possible.

Clearly state what you know and don't know

Finally, ATSDR is aware that some community members have expressed concern about other air emissions sources at YMR, such as those that might have occurred from plating, painting, and other processes. Site records indicate that YMR's processing rates were relatively constant from 1961 to the early 1980s, after which they rapidly declined due to external market forces. The decline in these operations (and presumably their associated air emissions) occurred at the same time as residential development increased in the area. Therefore, residents who moved into the neighborhoods that surround YMR were not exposed to air emissions that occurred when the facility operated at its highest production levels. While no sampling data are available to quantify the exact exposure levels that residents might have experienced from the late 1980s to the present, ATSDR notes that YMR's operations during this time frame were minimal.

IV. Evaluation of Health Outcome Data

This can be a separate section or incorporated into the discussion section.

In many cases, adequate data are not available to support a health outcome data evaluation. In such cases, your narrative should clearly explain why an assessment is not possible

If information is unavailable and, as a result, no conclusions can be drawn, simply state this fact.

In addition to studying exposure and substance-specific toxicity data, ATSDR also *considers* health outcome data, such as mortality and morbidity data, as part of the public health assessment process. ATSDR evaluates the following criteria when determining if the study of health outcome data is reasonable: (1) presence of a completed human exposure pathway, (2) great enough contaminant levels to result in measurable health effects, (3) sufficient people in the completed pathway for the health effect to be measured, and (4) a health outcome database where disease rates for populations of concern can be identified.

ATSDR identified two completed exposure pathways at YMR: exposure to arsenic in two private drinking wells and contact with PCBs in off-site soils in four nearby residential yards. For both pathways, the number of potentially exposed people is too few to enable a meaningful comparison with available health outcome databases (e.g., cancer registry data). Further, many of the long-term effects known to be associated with arsenic or PCB exposures (e.g., skin, immunological, or neurological conditions) are not reported in available disease registries. Therefore, the study of health outcome data was not relevant. See Section V (Community Health Concerns) for further discussion on the symptoms and other health concerns reported by community members.

Lastly, the presence of a completed air exposure pathway remains uncertain because no measured air contaminant data exist. If data generated from the planned air sampling program indicate harmful air exposures may be occurring, ATSDR will re-evaluate the appropriateness of studying health outcome data for any identified exposed or potentially exposed population.

V. Community Health Concerns

Answer specific questions based on the findings of your exposure and health effects evaluations.

Note to participants in ATSDR's Basic Course: Not all community concerns voiced at the field practicum are reflected here. It can be presumed that, during the public meeting after the initial site visit, ATSDR's health assessor addressed some of the community concerns that were initially expressed. The purpose of this section of the sample PHA is to provide examples of the general way in which ATSDR responds to community health concerns.

Depending on the specific issues and site-specific facts, responses will vary in length and level of detail.

Responding to community health concerns is an essential part of ATSDR's overall mission and commitment to public health. ATSDR identified several community health concerns through the petition letter, the site visit, a thorough review of site documents, and subsequent meetings and correspondence with community members, state and local officials, and past YMR site personnel.

ATSDR has already responded to some community members' concerns during the past public meeting for the site. Following are ATSDR's responses to the community concerns that were expressed most frequently or those that community members specifically asked be documented in this PHA.

1. **Could illnesses reported by some areas residents be the result of drinking contaminated water?**

   Community members have expressed concern regarding the reported presence of elevated levels of arsenic in private wells north of the site. Some have questioned whether other chemicals associated with the YMR site are present in area wells. Some site neighbors have reported health problems, such as headaches, insomnia, gastrointestinal distress, and general weakness.

   As described in the discussion, arsenic was detected at elevated levels in two private wells north of the site. Arsenic was not detected or detected at very low levels in all other wells identified and tested as part of an area well survey. No harmful levels of any other substances were detected in any of the tested private wells.

   The elevated levels of arsenic detected in the two private wells were high enough to raise some concern regarding long-term exposure. For that reason, residences were connected to the municipal water supply. Note, however, that estimated arsenic doses fell below doses shown to be associated with health effects. Further, residents who used these wells did not report any of the hallmark symptoms of chronic arsenic exposure (e.g., skin lesions, peripheral neuropathy, cancer). Therefore, ATSDR does not believe that reported symptoms are likely to be associated with drinking water from affected wells.

2. **Are children being exposed to harmful levels of lead in the soil as a result of the past sandblasting at the water tower?**

   The water tower at YMR was built in 1963, and has been sandblasted at least twice during maintenance activities. A resident of the neighborhood east of the site was concerned that dust containing lead-based paint might have blown into the neighborhood. The resident is concerned that young children may contact lead in the soil when they play outside.

As throughout the document, use plain language. If a more detailed technical backup is necessary to support a response, include it in an appendix.

The water tower is on site about 500 feet from the eastern facility boundary. There is very little information from the first time the water tower was sandblasted and repainted (late 1970s). However, the more recent 1998 maintenance activities were well documented. Both the New Minglewood County Health Department and YMR officials inspected the site during the sandblasting activities to confirm that the contractors used proper containment measures (such as covering the ground with tarps and controlling the amount of lead-based paint residue) (Williams 1995). Further, sandblasting occurred only when the winds were calm to promote deposition beneath the water tower. However, no confirmatory soil sampling was conducted.

At ATSDR's request, the on-site contractor collected four composite surface soil samples (0–6 inches) around the water tower and analyzed them for lead. The area under the water tower was quartered and three samples (one under the tank, one between the support legs, and one about 5 feet out) were taken from each quarter for the composite (QA Environmental Consulting 2004). The lead levels were only slightly elevated above background and were well below EPA's residential lead hazard standard for play areas (400 ppm). Therefore, since the soil directly beneath the water tower does not contain harmful levels of lead, ATSDR expects that very little, if any, lead-based dust would have traveled into off-site residential neighborhoods during the sandblasting activities.

3. Have past radiation releases affected people living in residential areas near YMR?

Two former waste piles were suspected of containing radioactive wastes. Records indicate that all hazardous materials were removed from the former waste pile area in 1986, and sent to an approved site. However, no environmental data exist to substantiate whether all hazardous materials were indeed removed. An initial survey was conducted in 1990; however, due to the presence of building rubble and fertilizers, which can contain elevated levels of naturally occurring radioactive materials, the results were inconclusive (ABC Environmental 1992). Subsequently, soil samples were taken at the location of the former waste piles and tested for radionuclides (Alpha 1994; ABC Environmental 2004). None of the results were elevated above typical background levels. Therefore, people living near YMR are not currently being exposed to harmful levels of radioactivity from YMR.

If information is not available to answer a question or a firm conclusion cannot be made, state so.

It is unknown whether radioactive wastes were present at the former waste piles prior to remediation. Because YMR was not fenced during this time, people could have accessed the site and contacted radioactive contamination, if it was present.

4. Are contaminants from YMR causing local well water to smell funny?

Contaminants from YMR are not migrating off site. Naturally occurring sulfates may be the source of the odor to the well water. Sulfur-reducing bacteria chemically change natural sulfates in water to hydrogen sulfide, which produces a "rotten egg" odor and taste in the water. These bacteria live in oxygen-deficient environments, such as deep wells, plumbing systems, water softeners, and water heaters. EPA recommends testing for hydrogen sulfide, corrosion, and metals in the water when an objectionable taste or smell occurs. For additional guidance about testing private drinking water wells, contact EPA's Safe Drinking Water Hotline at 1-800-426-4791 or visit EPA's Web site: http://www.epa.gov/safewater/pwells1.html.

5. Is PCB contamination from YMR causing children at the daycare center to be sick?

The Early Learning Daycare Center is east of YMR. It is **NOT** in the same area where PCB contamination extends off site. Further, to address the concern, sampling was conducted in the daycare center play areas and PCBs were not detected.

6. Was the housing complex east of YMR built on an old landfill?

There have been rumors of a landfill beneath the housing development to the east of YMR. However, further review of site records determined that no formal landfill existed in that area. YMR previously disposed of trash and other non-hazardous waste in a small trench on the eastern border of the site. However, the wastes were removed and the trench was covered with several feet of clean soil in the early 1980s (i.e., before the housing development was built). For this reason, ATSDR does not expect the "landfill" to be a hazard.

Where possible, try to address community health concerns even if the issue is not related to the site, but generally the focus is on contaminant releases associated with the site itself.

7. Are pesticides used in the past by a local dairy farm affecting the health of people now living and gardening in the area?

ATSDR determined that no harmful exposures to pesticides are currently occurring because residual contamination has been removed from the area of concern. Based on a limited amount of historic sampling data, it is unlikely that pesticide levels were present in sufficient quantities in the past to produce adverse health effects. Even if exposures were greater than available data suggest, the types of acute effects associated with chlorfenvinphos are reversible with no long-lasting effects expected.

In the late 1970s, a farm located upstream from YMR used pesticides containing chlorfenvinphos to control flies, fleas, and other external parasites on some of the farm animals. Drums containing residual amounts of these pesticides were found along Haynes Creek, upstream of YMR. The farm owners claimed that the drums were empty. Some elderly residents living in the cooperative now located where the farm once was reportedly have suffered from symptoms such as headaches, nausea, anxiousness, confusion, and weakness whenever they work in the community garden next to the creek.

Chlorfenvinphos and some other pesticides are known to affect the nervous system at high enough levels. ATSDR, therefore, searched for environmental sampling data to evaluate what, if any, exposures occurred in the area of reported concern, currently or in the past. Only a single data set collected from Haynes Creek in 1998 by a local university was identified to characterize past exposure conditions in which surface water and sediment samples were analyzed for pesticides and metals. Chlorfenvinphos was detected at elevated levels in creek sediments not to far from where the discarded drums were initially found. However, estimated exposure doses associated with the highest detected levels of chlorfenvinphos (29,000 ppm) are about 40 times lower than those shown to cause adverse health effects in experimental animal studies. Only in cases of accidental poisonings or suicide attempts have mild to severe effects (e.g., nausea, weakness, twitching, apprehension, unconsciousness) been reported in people. Therefore, unless people contacted much higher levels of this chemical than those reported in available sampling data, adverse acute health effects are not likely. Further, available medical data indicate that effects are reversible once exposure is stopped, and no evidence exists that long-term exposure to small amounts of chlorfenvinpos causes any other harmful health effects in people (ATSDR 1997).

In 2001, a new sewer line was installed in the area, requiring excavation of sediments and re-routing of the creek. Soil and sediments were removed and the area was covered with clean fill. Follow-up testing of soil in the entire stretch of Haynes Creek upgradient of YMR, including garden areas, revealed no elevated levels of metals or pesticides. Therefore, neither adults nor children who might garden or play in the area would be expected to suffer any ill health effects now or in the future.

8. Are residents exposed to PCBs when they garden?

Relatively extensive surface soil sampling for PCBs has occurred at the homes nearest YMR's former processing areas. Evidence of site-related PCB contamination has been found at four properties. The owners of these properties have been informed about this contamination and the steps they should take to minimize their exposures until YMR cleans up the contaminated soils. There is no evidence of site-related PCB contamination being found in any other homes and gardens around the YMR property.

9. Were children who occasionally cut across YMR on the way to school exposed to harmful levels of chemicals in the soil, before YMR installed the perimeter fence in 1993?

Even though children may have gained access to YMR property in the past, anecdotal evidence suggests that children did not remain on the property for prolonged time periods or trespass on a regular basis. Therefore, the children were not exposed to contamination for long durations. Additionally, school age children are not as predisposed to incidentally consume or come in contact with contaminated soil as a younger child might. For the substances present in soil at YMR, harmful health effects are not expected to occur from this kind of infrequent and occasional exposure to contaminated surface soil.

10. Is it possible that contaminants previously used at YMR have entered the food chain, such as local plants and livestock?

Some residents have asked ATSDR if soil contaminants at YMR could have entered the food chain, whether through plants or livestock. This issue has been addressed by the animal research facility that currently leases YMR's property. Among the lessee's research projects is one that is evaluating the extent to which certain metals and organic chemicals accumulate in plants and animals. This research (Hamilton 2003) concludes that the contamination found at YMR is not accumulating in the food chain at levels of health concern. ATSDR has placed copies of journal articles and related reports that address this issue in the record repository.

VI. Child Health Considerations

A separate discussion on child health considerations is required in all PHAs.

ATSDR recognizes that infants and children may be more sensitive to exposures than adults in communities with contamination in water, soil, air, or food. This sensitivity is the result of a number of factors. Children are more likely to be exposed because they play outdoors and they sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than adults, which means they breathe dust, soil, and heavy vapors close to the ground. Children are also smaller, potentially resulting in higher doses of chemical exposure per unit body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care. Therefore, ATSDR is committed to evaluating their special interests at sites such as the YMR.

ATSDR has attempted to identify populations of children in the vicinity of YMR site. Approximately 450 children under the age of 6 years live within a 1-mile radius of the YMR site (U.S. Bureau of the Census 2000). The Early Learning Daycare Center is east of the site.

To evaluate whether children may experience adverse health effects through past, current, or future exposures to site contaminants, ATSDR estimated the potential doses for children. To estimate these doses, ATSDR used assumptions that would be protective of child exposures. *ATSDR concluded that exposure to site contamination at the YMR site does pose some possible public health hazards for children.* This conclusion is based on ATSDR's exposure evaluation and the following information:

- Elevated arsenic levels detected in two private wells would pose a potential hazard to children drinking this water over the course of several years (more than 10 years). It is unlikely, however, that short-term (less than 3 years) use of well water would pose any hazard to children.
- PCB-contaminated surface soils pose a public health hazard to children who live at four homes southeast of the YMR facility. This hazard does not exist for adults, because the estimated exposure doses for children are 20 times higher.
- The levels of chemicals detected in the off-site portions of Haynes Creek are too low to be of health concern for children playing in the creek. Even though a localized high concentration of mercury was detected in the sediments on site, children are not expected to be contacting on-site sediments on a regular basis because a fence surrounds the facility.
- ATSDR will evaluate whether the air exposure pathway presents any unique hazards for children, once sampling data for the site become available.

VII. Conclusions

Conclusion statements must be fully consistent with information presented in the PHA and should not introduce any new information.

All conclusion statements should be succinct and not repeat large portions of statements presented in the Discussion section.

When site conditions have varied over time, it may be appropriate to assign a separate conclusion category for past, current, and future exposure conditions.

Determining the appropriate hazard category requires professional judgment. You need to decide what category best describes site conditions.

When communicating conclusions, clearly describe the essential message of the PHA in plain language, both in terms of what is and is not known, before presenting the specific conclusion category.

On the basis of its evaluation of available environmental information, ATSDR concluded that some exposure situations at the YMR site pose ***public health hazards***. Conclusions regarding medium- and site-specific exposures are as follows:

See Appendix A for definitions of ATSDR's conclusion categories.

- At off-site locations, four homes along the southeastern border of the facility have PCB surface soil contamination that could be harmful to children who contact the contamination in their yards. Ingestion of the contaminated soil poses a ***public health hazard*** for any children who live at these four homes.

- Though not believed to be site-related, long-term exposure to arsenic found in two private wells north of the site could result in adverse health effects and; therefore, posed a ***past public health hazard***. To prevent future exposures, these residences were connected to safe municipal water.

- Exposure to contaminants released to the air from the incinerator at YMR property poses an ***indeterminate public health hazard*** because ATSDR does not have sufficient data to make a decision. An air monitoring study is currently being conducted to characterize air quality impacts from the incinerator. ATSDR will evaluate the sampling data, once they are available, to determine whether the air exposure pathway presents a hazard.

- Contaminants were detected in Haynes Creek. However, the off-site concentrations are too low to pose a health hazard for anyone incidentally contacting surface water or sediment upstream or downstream of YMR. Therefore, ***no apparent public health hazard*** exists for people who come in contact with off-site sections of Haynes Creek.

- Contaminated on-site surface soils are not a health hazard to residents because they cannot access YMR property. The on-site contamination has not been a health hazard to workers due to their limited contact with soils. Therefore, on-site soil poses ***no apparent public health hazard***.

- No exposure or hazard exists for groundwater beneath YMR because no one is using the groundwater on site. Therefore, on-site groundwater poses ***no public health hazard***.

VIII. Recommendations

Recommendations should be ordered and parallel with the conclusions.

PHA recommendations should emphasize prevention of releases and prevention of exposure and any precautions required to ensure that public health is protected.

Because ATSDR is an advisory agency and not a risk management agency, your recommendations may identify actions that other entities (e.g., site owners, state health or environmental agencies, as well as divisions within ATSDR) will need to take to implement the recommendations. Be sure to confirm that the indicated entity will implement the recommendation.

- ATSDR recommends that YMR remove PCB-contaminated soils from the four residential properties this spring. Confirmation sampling is needed to ensure that all contamination, including potential subsurface contamination, is removed. EPA and ZEA oversight of this removal is needed to ensure that it is conducted effectively and in a manner that does not cause unacceptable exposures to PCBs. Until this removal is completed, residents of these four properties are cautioned to reduce activities that cause them to contact soils, such as gardening, playing, and allowing pets to access contaminated areas.

- ATSDR recommends that the contractor implementing the ambient air sampling program inform the agency when the program is finished and provide a copy of the complete sampling report.

- ATSDR recommends that YMR, as property lessor, develop and implement a site health and safety plan that informs all workers (regardless of their employer) of potential health hazards associated with contacting contaminated soils at on-site waste disposal areas. YMR should also post signs in the contaminated areas that warn workers to avoid contact with the soil.

IX. Public Health Action Plan

In the PHAP, outline actions or activities that have already been taken to protect public health, activities that are currently underway, and activities that will be conducted in the future.

The Public Health Action Plan (PHAP) for the YMR site lists important public health actions taken to date as well as actions that should be taken in the future. As such, the PHAP ensures that this PHA not only identifies potential and ongoing public health hazards, but also provides a plan of action to mitigate and prevent adverse human health effects from occurring in the future. The public health actions that are completed, ongoing, and planned are listed below.

Completed Actions

1. From the early 1980s to the present, YMR conducted multiple sampling investigations and removal efforts to evaluate the nature and extent of contamination and to ensure that the contamination does not reach off-site locations.

2. In the 1990s, multiple parties (Zarizona University, Middle University, EPA) conducted separate studies of contamination levels in Haynes Creek.

3. In 2001 and 2002, ZDHS identified all private well users in the vicinity of YMR and sampled the water that these wells produced.

4. In 2002, ZDHS recommended that the two well owners with elevated arsenic contamination immediately begin using bottled water for drinking and cooking purposes.

5. In June 2004, ATSDR conducted an initial site visit to YMR to tour the site, gather environmental data, and meet with the petitioner, health officials, representatives of EPA, and the community.

6. In September 2004, ATSDR held an additional public meeting to identify the health concerns of interest to the community and to provide the community progress reports on the PHA.

7. In September 2004, ATSDR provided health education to residents of the four properties on how to reduce their exposure to contaminated surface soils.

8. In January 2005, residents to the north of YMR were connected to the municipal water supply.

Ongoing Actions

1. YMR continues to operate the groundwater treatment system and the quarterly groundwater monitoring plan to reduce the contamination in the water and detect whether site-related contaminants have the potential to migrate off site.

2. A contractor to the animal research facility continues to collect air samples to help characterize potential air quality impacts from the site's incinerator. Preliminary data are expected to be available this summer.

Planned Actions

1. This spring, YMR, under EPA and ZEA oversight, will remove PCB-contaminated soils from four residential properties located southeast of the site and will conduct confirmation sampling to ensure that the contamination has been removed.
2. ATSDR will evaluate the ambient air sampling data being collected by the contractor to the animal research facility as soon as they become available. ATSDR will publish its findings on the air exposure pathway in a separate health consultation, which should be issued shortly after the sampling data are released.

X. Preparers of Report

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XI. References

Always do a final check to ensure that all text citations are properly referenced in the References section.

Refer to ATSDR's Style Guide (2000) for the preferred format.

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TABLES

Table 1. Exposure Pathways

Pathway Name	*Exposure Pathway Elements*					*Time Frame for Exposure*
	Source of Contamination	*Fate and Transport*	*Point of Exposure*	*Route of Exposure*	*Potentially Exposed Population*	
Completed Pathways						
Private drinking water	Unknown	No evidence of migration of site contaminants off site	Tap water in homes that use private wells	▪ Ingestion ▪ Skin contact	Residents in the 12 homes not on the municipal water supply	Past
Off-site soils	PCBs from discharging of transformer fluids	No evidence of contamination migrating (disposal off site occurred)	Soils southeast of the facility	▪ Ingestion ▪ Skin contact	Residents of 4 homes with backyards along the fence-line	Past Current Future
Potential Pathways						
Off-site sediments in Haynes Creek	Mercury residue that was pumped into Haynes Creek	There is no evidence of mercury migrating from the on-site sediments to downstream locations	Off-site sediments in Haynes Creek	▪ Ingestion ▪ Skin contact	People walking or wading in the creek	Past Current Future
Surface water in Haynes Creek	Contaminants in the sediments that enter the water column		Downstream areas of Haynes Creek	▪ Ingestion ▪ Skin contact	Recreational users of Haynes Creek	Past Current Future
Soils at waste units on site	Waste ponds, waste piles, spray irrigation field, and other disposal areas	No evidence of contamination migrating, except toward groundwater	On-site waste disposal areas	▪ Ingestion ▪ Skin contact	Workers might have limited contact with waste areas	Past Current Future
Inhaling air when the facility operated	Emissions from plating operations and other sources	Winds carried emissions to off-site locations	Locations in the immediate vicinity of the facility	▪ Inhalation	Residents who lived in the area prior to 1993	Past
Inhaling air after the facility shut down	Emissions from the incinerator and other minor operations	Winds carried emissions to off-site locations	Locations in the immediate vicinity of the facility	▪ Inhalation	Residents who lived in the area after 1993	Current Future

Pathway Name	Exposure Pathway Elements					Time Frame for Exposure
	Source of Contamination	Fate and Transport	Point of Exposure	Route of Exposure	Potentially Exposed Population	
Eliminated Pathways						
Contacting groundwater from the TCE plume	Solvents released from a leaking drum	Plume is beneath the waste pile now.	None. No one uses groundwater beneath the site.	▪ None	None	None
Contacting on-site sediments in Haynes Creek	Mercury residue that was pumped into Haynes Creek	There is no evidence of mercury migrating from the on-site sediments to downstream locations.	None. No one accesses this part of Haynes Creek.	▪ None	None	None
Fish caught from Haynes Creek	Mercury in the sediments that enters the aquatic food chain	Mercury may be entering the aquatic food web.	None. Fish in Haynes Creek are too small to eat.	▪ None	None	None

Table 2. Chemicals Detected in Surface Water from Lake Lanier

Chemical	*Range of Detections (ppb)*	*Average (ppb)*	*Frequency of Detections*	*Frequency Above Comparison Value*	*Comparison Value (ppb)*	*Type*
Barium	0.1–0.5	0.4	16/40	0 0	700 2,000	child RMEG MCL
Lead	1–4	2.3	30/40	0	15	EPA Action Level
TCE	0.1–0.3	0.2	8/40	0	5	MCL

Source: Faulkner 2003

EPA – U.S. Environmental Protection Agency
MCL – maximum contaminant level
ppb – parts per billion
RMEG – reference dose media evaluation guide

Table 3. Chemicals Detected in Private Wells

Chemical	*Range of Detections (ppb)*	*Average (ppb)*	*Frequency of Detections*	*Location of Maximum Detection*	*Frequency Above Comparison Value*	*Comparison Value (ppb)*	*Type*
Arsenic	0.5–87	54	12/12	WV-001	12	0.02 3	CREG C-EMEG (child)
Cadmium	ND–1	0.5	4/12	WV-002	0	2	C-EMEG (child)
Lead	5–12	9	20/20	WV-001	0	15	EPA Action Level
Manganese	3–29	11	12/12	WV-002	0	500	C-EMEG (child)
Zinc	200–550	320	12/12	WV-002	0	3,000	C-EMEG (child)

Source: ZDHS 2001, 2002

C-EMEG – chronic environmental media evaluation guide
CREG – cancer risk evaluation guide
EPA – U.S. Environmental Protection Agency
ND – non detect
ppb – parts per billion
RMEG – reference dose media evaluation guide
WV – private well

Table 4. Chemicals Detected in Surface Water from Haynes Creek

Chemical	***Range of Detections (ppb)***	***Average (ppb)***	***Frequency of Detections***	***Frequency Above Comparison Value***	***Comparison Value (ppb)***	***Type***
Metals						
Aluminum	29–104	52	11/48	0	20,000	I-EMEG (child)
Barium	41–79	62	12/48	0	700	RMEG (child)
Copper	2.2–4.0	3.4	6/48	0	1,300	MCL
Manganese	12–342	87	12/48	0	500	RMEG (child)
Mercury	0.1–1.5	1.1	12/48	0	2	MCL (inorganic Hg)
Organic Compounds						
Diethylphthalate	0.8–1.0	0.9	2/12	0	8,000	RMEG (child)
Naphthalene	1–5	3.2	4/12	0	20	LTHA

Sources: EPA 1998; Middle University 1998; Zarizona University 2002

I-EMEG – intermediate environmental media evaluation guide
LTHA – lifetime health advisory for drinking water
MCL – maximum contaminant level
ppb – parts per billion
RMEG – reference dose media evaluation guide

Table 5. Chemicals Detected in Sediment from Haynes Creek

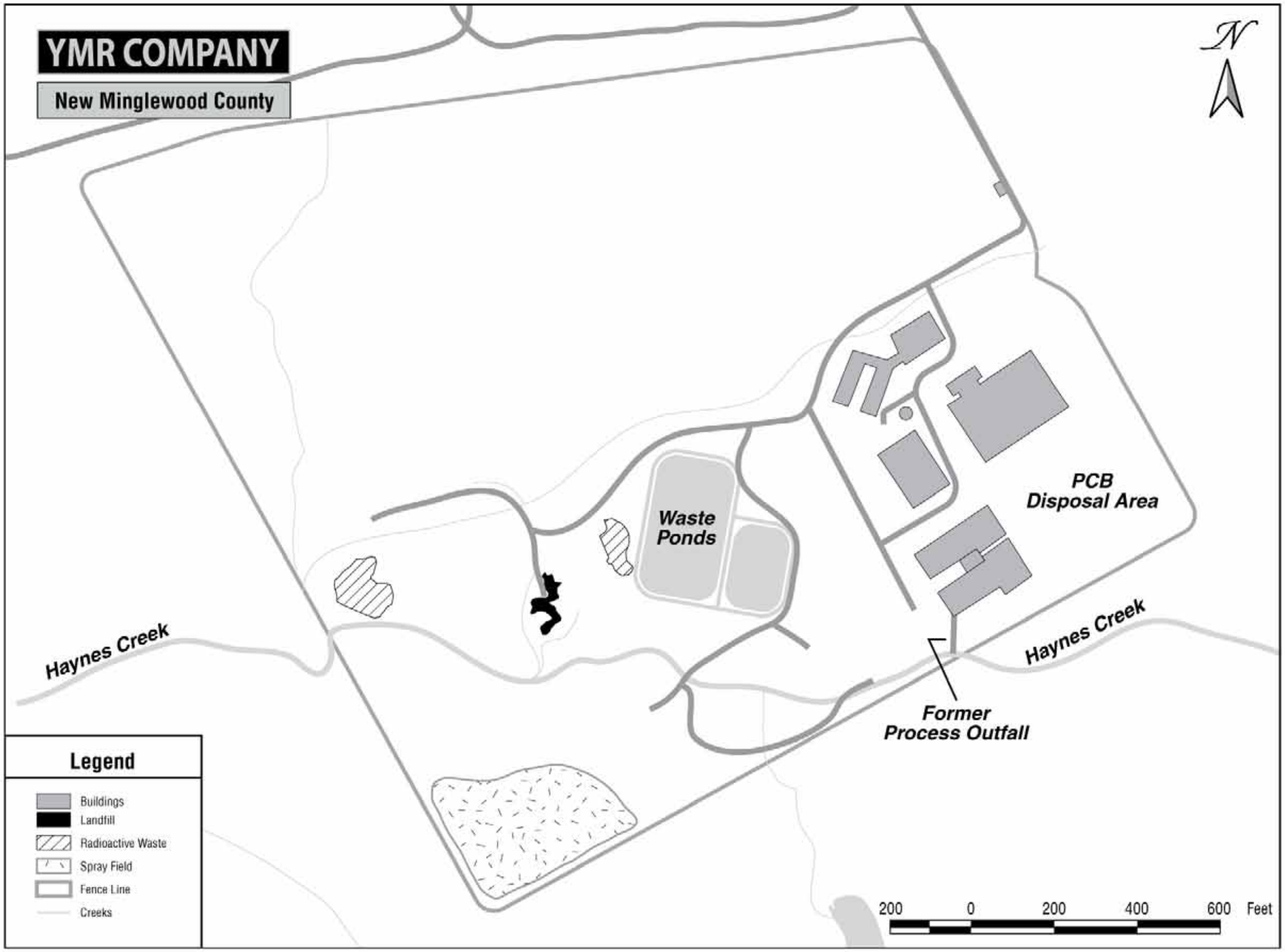
Chemical	*Range of Detections (ppm)*	*Average (ppm)*	*Frequency of Detections*	*Location of Maximum Detection*	*Frequency Above Comparison Values*	*Comparison Value (ppm)*	*Type*
Metals							
Arsenic	0.1–5	0.4	15/20	Off site	5 0	0.5 20	CREG C-EMEG (child)
Barium	70–145	112	20/20	On site	0	3,000	RMEG (child)
Chromium III	25–330	68	20/20	Off site	0	80,000	RMEG (child)
Lead	15–52	22	15/20	Off site	0	400	SSL
Manganese	115–190	151	20/20	On site	0	3,000	RMEG (child)
Mercury	0.05–150	23	15/20	On site	1	20	RMEG (child) (mercuric chloride)
Organic Compounds							
1,2-Dichlorobenzene	0.03	0.03	1/13	On site	0	5,000	RMEG (child)
1,4-Dichlorobenzene	0.08	0.08	1/13	Off site	0	20,000	I-EMEG (child)
1,2-Dichloroethane	0.09	0.09	1/13	On site	0	10,000	I-EMEG (child)
1,1,2-Trichloroethane	1.9	1.9	1/13	On site	0 0	10 200	CREG RMEG (child)

Sources: EPA 1998; Middle University 1998; Zarizona University 1998, 2002

C-EMEG – chronic environmental media evaluation guide
CREG – cancer risk evaluation guide
I-EMEG – intermediate environmental media evaluation guide
ppm – parts per million
RMEG – reference dose media evaluation guide
SSL – soil screening level

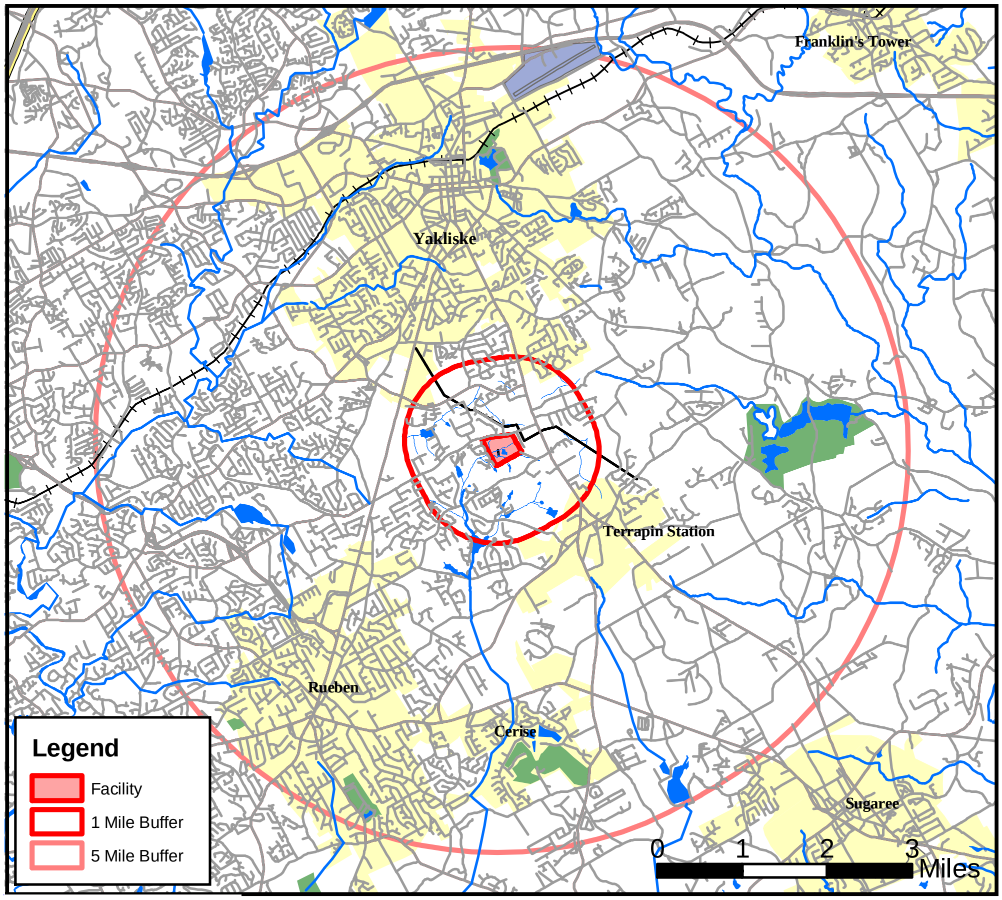
FIGURES

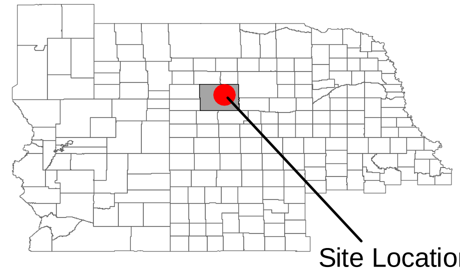
Figure 1. Yakliske Metals and Reclamation Company Site Features



Yakliske Metals and Reclamation

INTRO MAP





New Minglewood County, ZA

Yakliske, ZA

CERCLIS # ZA000000001

Demographic Statistics Within One Mile of Site*	
Total Population	5,310
White	4,434
Black	549
American Indian, Eskimo, Aleut	3
Asian	146
Pacific Islander	0
Other Race	121
Two Race	53
Hispanic Origin	248
Children Aged 6 or Younger	659
Adults Aged 65 or Older	299
Females Aged 15 - 44	1,275
Total Housing Units	1,755

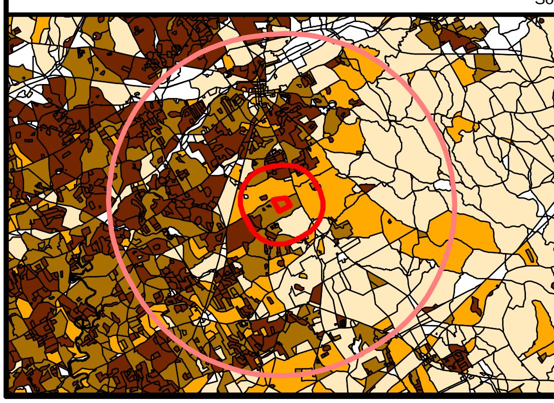
Base Map Source: GDT, 2002

Demographics Statistics Source: 2000 US Census
*Calculated using an area-proportion spatial analysis technique

GRASP
GEOSPATIAL RESEARCH, ANALYSIS & SERVICES PROGRAM

Population Density

Source: 2000 US Census

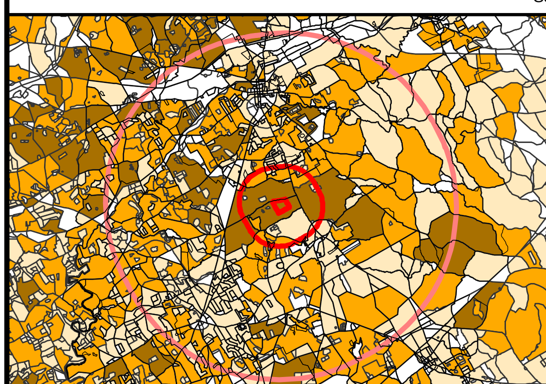


- Zero Population *
- >0 - 500 *
- >500 - 1000 *
- >1000 - 2000 *
- >2000 *

* Persons / Sq Km

Children 6 Years or Younger

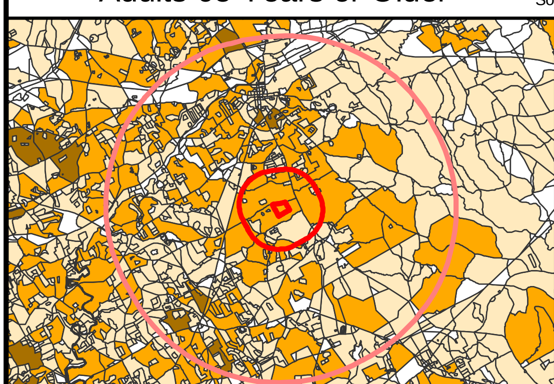
Source: 2000 US Census



- Zero Population
- 1 - 19 Children
- 20 - 99 Children
- 100 + Children

Adults 65 Years or Older

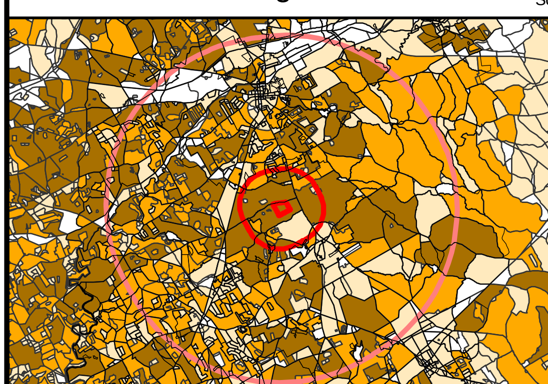
Source: 2000 US Census



- Zero Population
- 1 - 19 Seniors
- 20 - 99 Seniors
- 100 + Seniors

Females Aged 15 - 44

Source: 2000 US Census



- Zero Population
- 1 - 19 Females
- 20 - 99 Females
- 100 + Females

Figure 3. ATSDR Exposure Evaluation Process

REMEMBER: For a public health threat to exist, the following three conditions must all be met:

- Contaminants must exist in the environment
- People must come into contact with areas that have potential contamination
- The amount of contamination must be sufficient to affect people's health

Are the Environmental Media Contaminated?

ATSDR considers:

Soil
Ground water
Surface water and sediment
Air
Food sources

Are People Exposed To Areas With Potentially Contaminated Media?

For exposure to occur, contaminants must be in locations where people can contact them.

People may contact contaminants by any of the following three exposure routes:

Inhalation
Ingestion
Dermal absorption

For Each Completed Exposure Pathway, Will the Contamination Affect Public Health?

ATSDR will evaluate existing data on contaminant concentration and exposure duration and frequency.

ATSDR will also consider individual characteristics (such as age, gender, and lifestyle) of the exposed population that may influence the public health effects of contamination.

Figure 4. Location of Groundwater Monitoring Wells and Private Wells

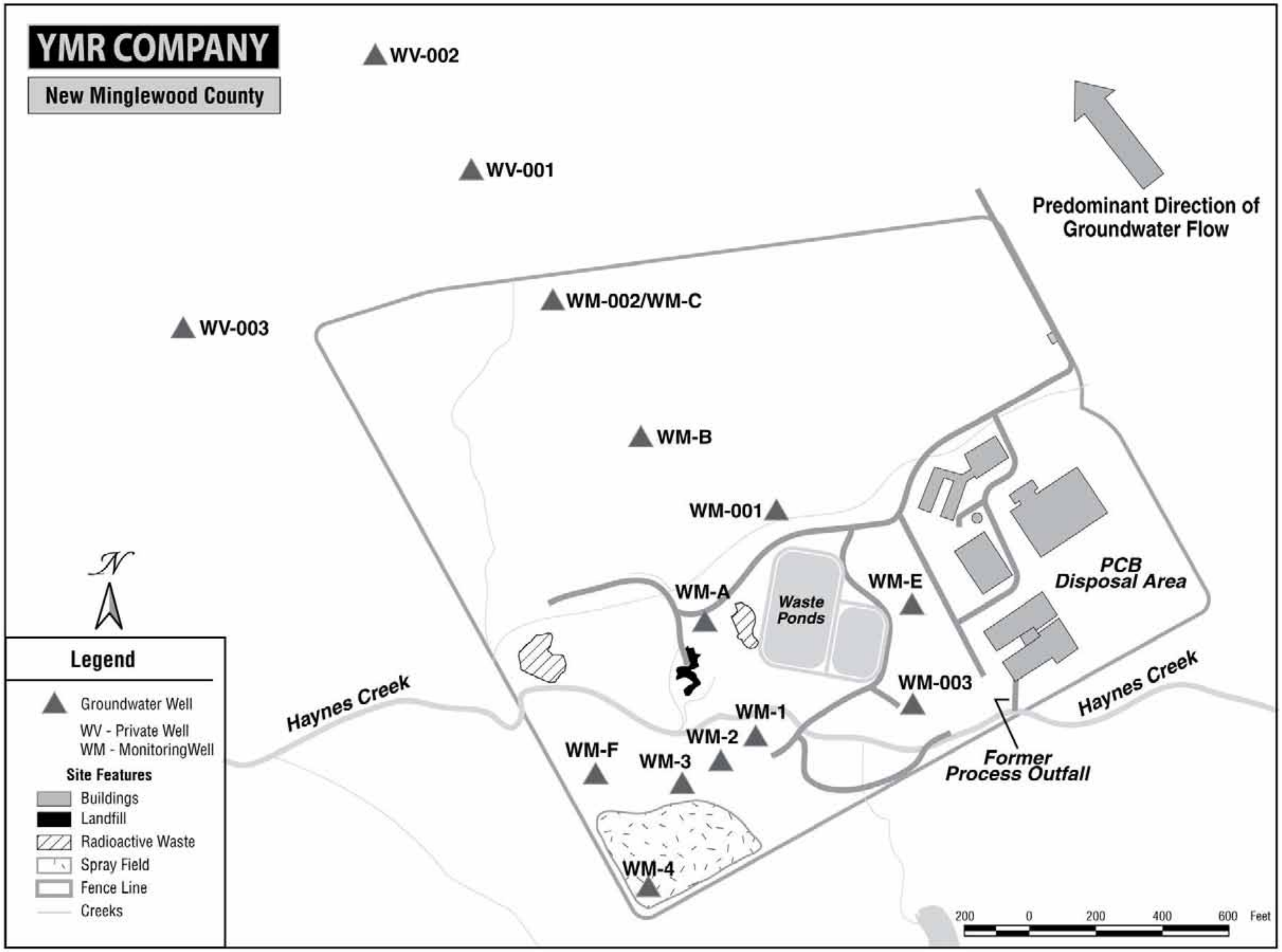


Figure 5. PCB Sample Locations

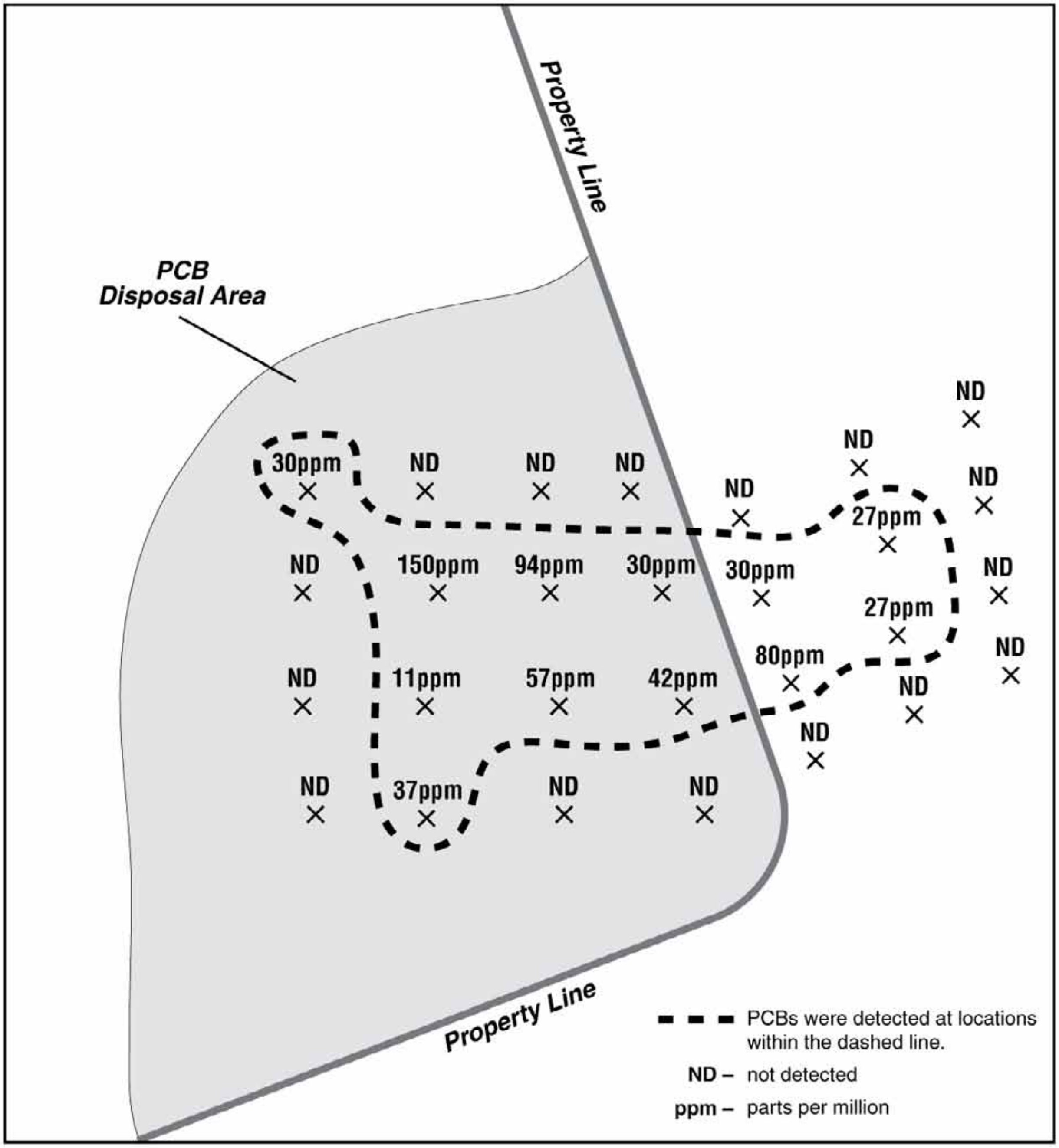
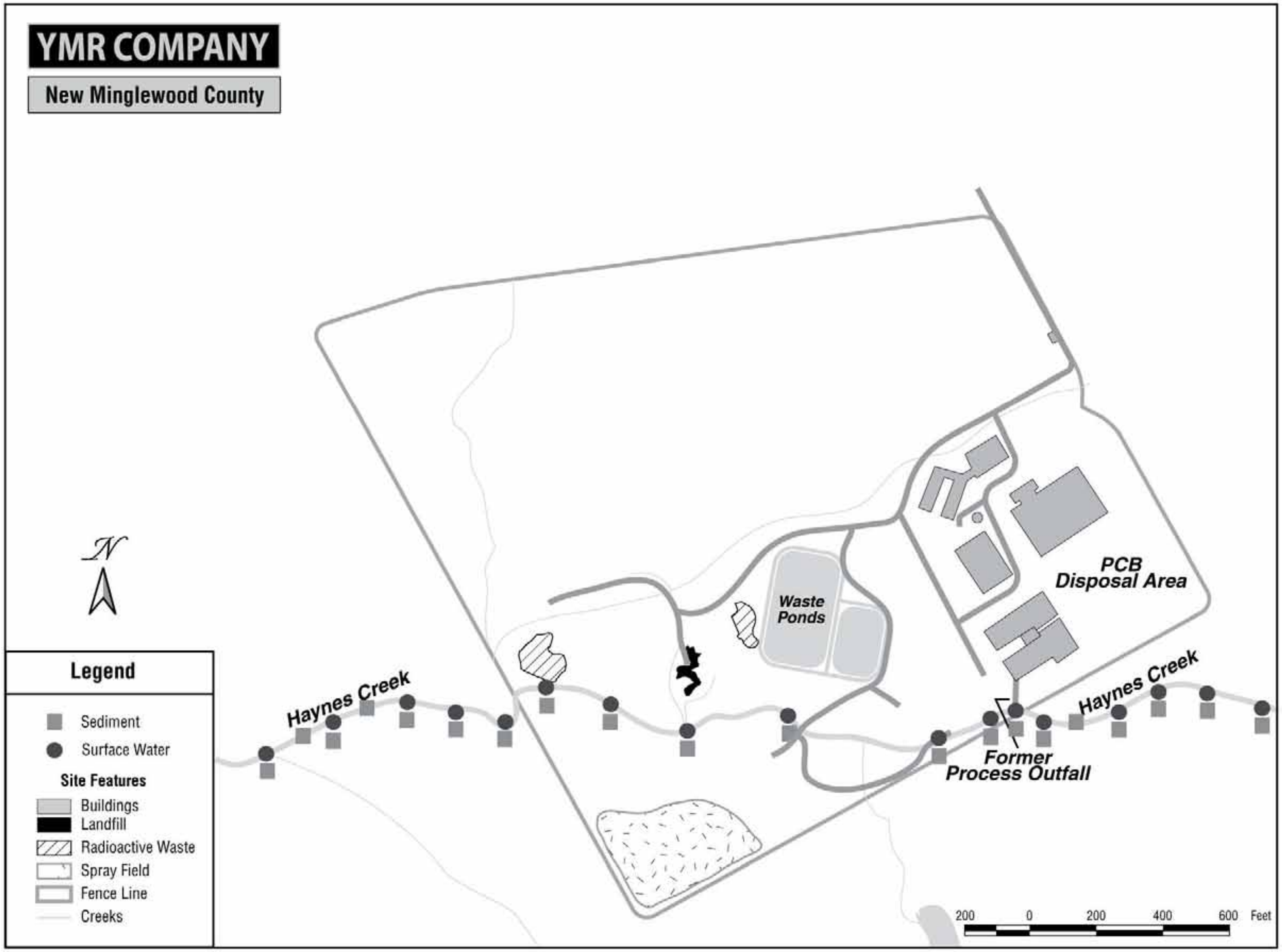


Figure 6. Location of Surface Water and Sediment Sampling



APPENDICES

Appendix A. ATSDR Glossary of Terms

The entire ATSDR glossary is provided here for reference purposes. In a real PHA, you should remove any terms that are not mentioned in the text.

You can add terms that are unique to your site.

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health. This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-42-ATSDR (1-888-422-8737).

Absorption
The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute
Occurring over a short time [compare with chronic].

Acute exposure
Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

Additive effect
A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with antagonistic effect and synergistic effect].

Adverse health effect
A change in body function or cell structure that might lead to disease or health problems

Aerobic
Requiring oxygen [compare with anaerobic].

Ambient
Surrounding (for example, ambient air).

Anaerobic
Requiring the absence of oxygen [compare with aerobic].

Analyte
A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Analytic epidemiologic study
A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect
A biologic response to exposure to multiple substances that is less than would be expected if the known effects of the individual substances were added together [compare with additive effect and synergistic effect].

Background level
An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation
Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study
A study that uses (a) biomedical testing or (b) the measurement of a substance [an analyte], its metabolite, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see exposure investigation].

Biologic monitoring
Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake
The transfer of substances from the environment to plants, animals, and humans.

Biomedical testing
Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

Biota
Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

Body burden
The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

CAP [see Community Assistance Panel.]

Cancer
Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

Cancer risk
A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen
A substance that causes cancer.

Case study
A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study
A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

CAS registry number
A unique number assigned to a substance or mixture by the American Chemical Society Abstracts Service.

Central nervous system
The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980]

Chronic
Occurring over a long time [compare with acute].

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

Cluster investigation
A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

Community Assistance Panel (CAP)
A group of people from a community and from health and environmental agencies who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

Comparison value (CV)
Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway [see exposure pathway].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
CERCLA, also known as Superfund, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances. This law was later amended by the Superfund Amendments and Reauthorization Act (SARA).

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect
A disease or an injury that happens as a result of exposures that might have occurred in the past.

Dermal
Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact
Contact with (touching) the skin [see route of exposure].

Descriptive epidemiology
The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit
The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Disease prevention
Measures used to prevent a disease or reduce its severity.

Disease registry
A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

DOD
United States Department of Defense.

DOE
United States Department of Energy.

Dose (for chemicals that are not radioactive)
The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An “exposure dose” is how much of a substance is encountered in the environment. An “absorbed dose” is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose (for radioactive chemicals)
The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

Dose-response relationship
The relationship between the amount of exposure [dose] to a substance and the resulting changes in body function or health (response).

Environmental media
Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism
Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an exposure pathway.

EPA
United States Environmental Protection Agency.

Epidemiologic surveillance [see Public health surveillance].

Epidemiology
The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

Exposure assessment
The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction
A method of estimating the amount of people's past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation
The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

Exposure registry
A system of ongoing followup of people who have had documented environmental exposures.

Feasibility study
A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Geographic information system (GIS)
A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

Grand rounds
Training sessions for physicians and other health care providers about health topics.

Groundwater
Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].

Half-life (t½)
The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half life is the amount of time necessary for one half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half lives, 25% of the original number of radioactive atoms remain.

Hazard
A source of potential harm from past, current, or future exposures.

Hazardous Substance Release and Health Effects Database (HazDat)
The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste
Potentially harmful substances that have been released or discarded into the environment.

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with public health assessment].

Health education
Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation
The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to evaluate the possible association between the occurrence and exposure to hazardous substances.

Health promotion
The process of enabling people to increase control over, and to improve, their health.

Health statistics review
The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

Indeterminate public health hazard
The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence
The number of new cases of disease in a defined population over a specific time period [contrast with prevalence].

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

Inhalation
The act of breathing. A hazardous substance can enter the body this way [see route of exposure].

Intermediate duration exposure
Contact with a substance that occurs for more than 14 days and less than a year [compare with acute exposure and chronic exposure].

In vitro
In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with in vivo].

In vivo
Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with in vitro].

Lowest-observed-adverse-effect level (LOAEL)
The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring
A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

Metabolism
The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite
Any product of metabolism.

mg/kg
Milligram per kilogram.

mg/cm^2
Milligram per square centimeter (of a surface).

mg/m^3
Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration
Moving from one location to another.

Minimal risk level (MRL)
An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see reference dose].

Morbidity
State of being ill or diseased. Morbidity is the occurrence of a disease or condition that alters health and quality of life.

Mortality
Death. Usually the cause (a specific disease, a condition, or an injury) is stated.

Mutagen
A substance that causes mutations (genetic damage).

Mutation
A change (damage) to the DNA, genes, or chromosomes of living organisms.

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)
EPA’s list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

National Toxicology Program (NTP)
Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

No apparent public health hazard
A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)
The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard
A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see National Priorities List for Uncontrolled Hazardous Waste Sites]

Physiologically based pharmacokinetic model (PBPK model)
A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica
A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Plume
A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure
The place where someone can come into contact with a substance present in the environment [see exposure pathway].

Population
A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP)
A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb
Parts per billion.

ppm
Parts per million.

Prevalence
The number of existing disease cases in a defined population during a specific time period [contrast with incidence].

Prevalence survey
The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

Prevention
Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public availability session
An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public comment period
An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public health action
A list of steps to protect public health.

Public health advisory
A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)
An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with health consultation].

Public health hazard
A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or radionuclides that could result in harmful health effects.

Public health hazard categories
Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are no public health hazard, no apparent public health hazard, indeterminate public health hazard, public health hazard, and urgent public health hazard.

Public health statement
The first chapter of an ATSDR toxicological profile. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public health surveillance
The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Public meeting
A public forum with community members for communication about a site.

Radioisotope
An unstable or radioactive isotope (form) of an element that can change into another element by giving off radiation.

Radionuclide
Any radioactive isotope (form) of any element.

RCRA [see Resource Conservation and Recovery Act (1976, 1984)]

Receptor population
People who could come into contact with hazardous substances [see exposure pathway].

Reference dose (RfD)
An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry
A systematic collection of information on persons exposed to a specific substance or having specific diseases [see exposure registry and disease registry].

Remedial investigation
The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA)
This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RFA
RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

RfD [see reference dose]

Risk
The probability that something will cause injury or harm.

Risk reduction
Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication
The exchange of information to increase understanding of health risks.

Route of exposure
The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Safety factor [see uncertainty factor]

SARA [see Superfund Amendments and Reauthorization Act]

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see population]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size
The number of units chosen from a population or an environment.

Solvent
A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination
The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an exposure pathway.

Special populations
People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder
A person, group, or community who has an interest in activities at a hazardous waste site.

Statistics
A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance
A chemical.

Substance-specific applied research
A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's toxicological profiles. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

Superfund [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)]

Superfund Amendments and Reauthorization Act (SARA)
In 1986, SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water
Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with groundwater].

Surveillance [see public health surveillance]

Survey
A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see prevalence survey].

Synergistic effect
A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see additive effect and antagonistic effect].

Teratogen
A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent
Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile
An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology
The study of the harmful effects of substances on humans or animals.

Tumor
An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor
Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a safety factor].

Urgent public health hazard
A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)
Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Other glossaries and dictionaries:
Environmental Protection Agency (http://www.epa.gov/OCEPAterms/)
National Center for Environmental Health (CDC)
(http://www.cdc.gov/nceh/dls/report/glossary.htm)
National Library of Medicine (NIH)
(http://www.nlm.nih.gov/medlineplus/mplusdictionary.html)

For more information on the work of ATSDR, please contact:
Office of Policy and External Affairs
Agency for Toxic Substances and Disease Registry
1600 Clifton Road, N.E. (MS E-60)
Atlanta, GA 30333
Telephone: (404) 498-0080

Appendix B. Estimates of Human Exposure Doses and Determination of Health Effects

The health effects evaluation consists of two pieces: a screening analysis and, at some sites, based on the results of the screening analysis and community health concerns, a more in-depth analysis to determine possible public health implications of site-specific exposures.

The Agency for Toxic Substances and Disease Registry (ATSDR) evaluated exposures to (1) groundwater; (2) soil; (3) surface water and sediment in Haynes Creek; and (4) air at the Yakliske Metals and Reclamation Company (YMR) site. To do so, ATSDR evaluated available data to determine whether contaminants were above ATSDR's comparison values (CVs). For those that were, ATSDR derived exposure doses and compared them against health-based guidelines. ATSDR also reviewed relevant toxicological data to obtain information about the toxicity of contaminants of interest.

Health assessors should ensure that they are using the most appropriate and up-to-date comparison values. ATSDR regularly updates its environmental and health guidelines. The most current values are entered into ATSDR's Hazardous Substance Database (HazDat). Detailed information about ATSDR's substance-specific health guidelines (MRLs) is provided in ATSDR's Toxicological Profiles. Information about EPA's health guidelines (RfDs) is reported in EPA's Information Risk Information System (IRIS) database: http://www.epa.gov/iris

Comparing Data to ATSDR's CVs

CVs are derived using conservative exposure assumptions. CVs reflect concentrations that are much lower than those that have been observed to cause adverse health effects. Thus, CVs are protective of public health in essentially all exposure situations. As a result, concentrations detected at or below ATSDR's CVs are not considered to warrant health concern. While concentrations at or below the relevant CV may reasonably be considered safe, it does not automatically follow that any environmental concentration that exceeds a CV would be expected to produce adverse health effects. It cannot be emphasized strongly enough that CVs are not thresholds of toxicity. The likelihood that adverse health outcomes will actually occur depends on site-specific conditions and individual lifestyle and genetic factors that affect the route, magnitude, and duration of actual exposure, and not an environmental concentration alone.

For this public health assessment (PHA), ATSDR evaluated data that were collected from groundwater, surface soil, surface water, sediment, biota, and air to determine whether people were exposed to contaminant concentrations that exceeded ATSDR's CVs. Most detected contaminants fell at or below CVs and were not evaluated further (see Table 2 through Table 5). Only arsenic in groundwater and PCBs in soil were detected above CVs. Contaminants that were above CVs were deemed worthy of further evaluation, prompting ATSDR to estimate exposure doses (i.e., the amount of chemical a person is exposed to over time) using site-specific exposure assumptions.

Deriving Exposure Doses

ATSDR derived exposure doses for those contaminants that were detected above ATSDR's CVs or did not have CVs. When estimating exposure doses, health assessors evaluate (1) contaminant concentrations to which people may have been exposed and (2) length of time and the frequency of exposure. Together, these factors influence an individual's physiological response to chemical contaminant exposure and potential outcomes. Where possible, ATSDR used site-specific information about the frequency and duration of exposures. In cases where site-specific information was not available, ATSDR applied several conservative exposure assumptions to estimate exposures for area residents.

The drinking water ingestion rates used in the analysis (2 L/day adults; 1 L/day children) are ATSDR defaults. You should evaluate whether the default ingestion rates are representative of conditions specific for your site (e.g., climate and use patterns).

The following equation was used to estimate exposure to contaminants in groundwater:

$$\text{Estimated exposure dose} = \frac{\text{Conc.} \times \text{IR} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

where:

- Conc.: Maximum concentration in parts per million (ppm)
- IR: Ingestion rate: adult = 2 liters per day; child = 1 liter per day
- EF: Exposure frequency, or number of exposure events per year of exposure: 365 days/year
- ED: Exposure duration, or the duration over which exposure occurs: adult = 30 years; child = 6 years
- BW: Body weight: adult = 70 kg; child = 10 kg
- AT: Averaging time, or the period over which cumulative exposures are averaged (6 years or 30 years x 365 days/year for noncancer effects; 70 years x 365 days/year for cancer effects)

The following equation was used to estimate exposure to contaminants in surface soil:

$$\text{Estimated exposure dose} = \frac{\text{Conc.} \times \text{IR} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

where:

- Conc.: Maximum concentration in parts per million (ppm)
- IR: Ingestion rate: adult = 100 milligrams (mg) per day; child = 200 mg per day
- EF: Exposure frequency, or number of exposure events per year of exposure: 365 days/year
- ED: Exposure duration, or the duration over which exposure occurs: adult = 30 years; child = 6 years
- BW: Body weight: adult = 70 kg; child = 10 kg
- AT: Averaging time, or the period over which cumulative exposures are averaged (6 years or 30 years x 365 days/year for noncancer effects; 70 years x 365 days/year for cancer effects)

Using Exposure Doses to Evaluate Potential Health Hazards

ATSDR performs an in-depth evaluation to determine whether exposures might be associated with adverse health effects (noncancer and cancer). As part of this process, ATSDR examines relevant toxicologic, medical, and epidemiologic data to determine whether estimated doses are likely to result in adverse health effects.

This is where you evaluate and integrate exposure data (site-specific exposure conditions that have been studied throughout the public health assessment process) and substance-specific health effects data (toxicologic, epidemiologic, and health outcome data).

The output of the analysis is a qualitative description of whether site exposure conditions are of sufficient nature, frequency, and magnitude to adversely affect public health.

ATSDR compares estimated exposure doses to standard health guideline values, including ATSDR's minimal risk levels (MRLs) and the U.S. Environmental Protection Agency's (EPA's) reference doses (RfDs). The MRLs and RfDs are protective estimates of daily human exposure to a substance that are unlikely to result in noncancer effects over a specified duration. These chemical-specific estimates, which are intended to serve as screening levels, are used by the ATSDR health assessor to identify contaminants and potential health effects that are not expected to cause adverse health effects. Estimated exposure doses that are less than these values are not considered to be of health concern. To maximize human health protection, MRLs and RfDs have built-in uncertainty or safety factors, making these values considerably lower than levels at which health effects have been observed. Therefore, if an exposure dose is much higher than the MRL or RfD, it does not necessarily follow that adverse health effects will occur.

If health guideline values are exceeded, ATSDR examines the effect levels seen in the literature and more fully reviews exposure potential to help predict the likelihood of adverse health outcomes. ATSDR looks at human studies, when available, as well as experimental animal studies. This information is used to describe the disease-causing potential of a particular contaminant and compare site-specific dose estimates with doses shown to result in illness in applicable studies (known as the margin of exposure). For cancer effects, ATSDR also reviews studies to determine the mode of action of a carcinogen and whether a threshold for its carcinogenicity might exist. This process enables ATSDR to weigh the available evidence, in light of uncertainties, and offer perspective on the plausibility of adverse health outcomes under site-specific conditions.

Evaluation of Health Hazards Associated with YMR

ATSDR identified several pathways that had the potential to lead to exposures (please refer to Table 1). For each of these completed and potential pathways, contaminant concentrations were compared to CVs when the data were available. Many of the contaminants were detected below their corresponding CVs. Only arsenic in groundwater and PCBs in soil were detected above CVs. Therefore, exposure doses were calculated for these two pathways. More detail about each of the exposure pathways follows.

Groundwater

Estimated arsenic doses in children and adults fall below levels at which observable effects have been reported in *human* studies, but by a factor of less than 10. Because of uncertainties regarding the toxicity of arsenic at low doses and the consistent detections of arsenic in the tested wells, prudent public health practice called for reducing exposures. Additional perspective is provided below.

The average concentration within a single well is a more appropriate concentration for evaluating chronic health effects. The maximum value should be considered, however, when evaluating possible acute effects.

ATSDR evaluated both acute (short-term exposure to the highest detected concentration) and chronic (longer-term exposure to the average detected concentration in the most contaminated well). The average level for the private well with the most elevated arsenic levels (WV-001) is 54 ppb. ATSDR considers this a reasonable estimate when evaluating possible long-term exposures. The maximum detected concentration was 87 ppb. See Table B-1.

Table B-1. Estimated Arsenic Exposure Doses Compared to Screening Values and Observed Effect Levels

Exposure Situation	*Exposure Concentration*	*Estimated Exposure Dose (mg/kg/day)*		*MRL (mg/kg/day)*	*NOAEL (mg/kg/day)*	*LOAEL (mg/kg/day)*
		Adult	*Child*			
Acute	87 ppb	0.0025	0.008	0.005	--	0.05
Chronic	54 ppb	0.0015	0.005	0.0003	0.0008	0.014

Acute doses fall below (adult) or slightly above (child) ATSDR's acute MRL of 0.005 mg/kg/day. Therefore, anyone drinking water with even the highest level of arsenic detected for a short period of time would not be at risk for harmful effects.

If an adult drank 8 glasses (2 liters) of water a day, that person's estimated dose would be **0.0015 mg/kg/day**, exceeding ATSDR's chronic MRL. Assuming a child drank half that amount of water, the estimated child dose would be **0.0054 mg/kg/day**. To determine whether harmful effects are possible, it is important now to compare the estimated dose in these adults to doses in human studies where harmful effects were observed. These doses are approximately 3 to 9 times lower than observed effect levels in *human* studies. So, what does this mean?

ATSDR's chronic MRL is based on a study of 40,000 persons in Taiwan who unknowingly used groundwater with arsenic for roughly 45 years (ATSDR 2000a). Because arsenic contamination was so high, people of all ages experienced harmful effects to the skin (specifically small blotches of increased skin pigmentation known as hyperpigmentation and a scaly skin condition known as keratosis), skin cancer, and several types of internal cancer.[2] The typical level of arsenic in drinking water was

[2] Arsenic-induced keratosis is a skin condition found most often on the feet and palms. Many small depressions occur in the skin with small, hard, outgrowths of skin in the center of each depression. Keratosis can also appear as scaling skin. Hyperpigmentation of the skin occurs as small brown areas or blotches on the skin around the eyelids, temples, neck, nipples, and groin. In severe cases, pigmentation might cover the chest, back, and stomach. It sometimes appears as mottling on the skin. If mottling occurs, it is more frequent on the chest, back, and stomach.

about 500 ppb, although some wells had as little as 50 ppb and some had more than 1,000 ppb. From this study, ATSDR selected an estimate of the lowest dose that is most likely to result in harmful effects. This dose is referred to as the lowest-observed-adverse-effect level (LOAEL). The LOAEL in the Chinese study was 0.014 mg/kg/day. The Chinese study also identified a dose at which no harmful effects were seen. This no-observed-adverse-effect level (NOAEL) was 0.0008 mg/kg/day (ATSDR 2000a).

As can be seen, estimated doses for children and adults are 3 and 9 times, respectively, lower than the lowest level at which harmful skin effects were reported in the Chinese study. This "margin of exposure" as it is sometimes referred to is small enough that some reduction of exposure is advisable. It is important to realize, however, that exposure has to occur for 10 to 40 years before damage to the skin occurs. Knowing that 10 to 40 years of exposure is needed adds some uncertainty in deciding whether or not harmful effects might occur because ATSDR only has information about arsenic levels in the past few years. Should arsenic levels in the wells go down, the risk of harmful effects would decrease; should arsenic levels in the wells go up, the risk of harmful effects might be increased should the same people continue to drink the water for several decades. It is important to know that drinking the water one time, a few times, or even for a few years is not likely to cause the noncancerous skin problems mentioned because the exposure period is too short (ATSDR 2000a).

Consult with a toxicologist as needed.

Regarding possible cancer effects, much uncertainty exists. Arsenic is classified as a known human carcinogen. At relatively high doses, several epidemiologic studies and case reports link the ingestion of inorganic arsenic with an increased risk of developing skin cancer, and possibly some internal cancer. However, scientists are uncertain about the behavior of arsenic in the body at low doses. Some data suggest that a person's body can safely handle a certain amount of arsenic before producing toxic effects; some believe this holds true for cancer. Given the uncertainties, scientists use very conservative models in extrapolating from observed effect levels to screening levels such as the slope factor used in deriving theoretical excess cancer risk.

If one looks at drinking water studies in this country and abroad, one generally sees that cancer effects are not observed at arsenic concentrations at or near the concentrations observed in YMR private wells. Many of the available studies relate to non-U.S. populations where the reliability of exposure data is questionable and many differences in health and nutrition make direct comparisons difficult. Some studies in this country may offer better perspective, but they are smaller scale and do not offer the statistical power of some of the studies done abroad. These studies do suggest that skin cancer from drinking water exposures to arsenic is not common in this country; no increases of skin cancer have been seen in small populations drinking 100 to 200 ppb arsenic in their water. These concentrations are higher than those detected in tested wells (ATSDR 2000a).

Surface Soil

This section documents in detail ATSDR's evaluation of exposures to PCB-contaminated surface soils at four off-site properties at YMR. Overall, the estimated exposures to PCBs (specifically, Aroclor 1254) in both adults and children are lower than levels at which observable effects have been reported in humans and in laboratory animals. The estimated exposure dose for children is less than 10 times lower than these effects levels—a margin that is rather small, especially considering the uncertainties regarding the toxicity of PCBs and the possibility of additional absorption through the skin. Therefore, prudent public health practice calls for reducing exposures to ensure that child residents of the contaminated properties do not experience PCB-related health effects. The remainder of this section describes how this conclusion was reached. ATSDR considered the public health implications of exposure for three exposure durations: acute (less than 14 days), intermediate (between 14 days and 1 year), and chronic (greater than 1 year). Noncancer outcomes are reviewed first, followed by cancer outcomes.

Acute Exposures (noncancer). No health-based comparison values have been published by any source for short-term (or acute) exposures to PCBs. Similarly, no data are available on adverse health effects in humans following acute ingestion exposure to PCBs. However, more than a dozen studies of laboratory animals have reported harmful effects following acute ingestion exposures (ATSDR 2000b). The lowest exposure level found to produce harmful effects following acute exposures was 1.0 mg/kg/day; in this study, rats experienced changes in their blood cholesterol levels and liver weight following 4 days of exposure (ATSDR 2000b). Using the standard dose calculation equation shown above, ATSDR found that a child who weighs 20 pounds and lives at the most contaminated home would have to eat approximately 0.25 pounds of soil per day to reach the lowest acute exposure dose found to be associated with harmful health effects. This soil ingestion rate is far greater than any reported in the literature, even for pica children (ATSDR 2001). Therefore, children who live in the four affected homes likely will not experience harmful exposures following acute exposures to surface soils.

Intermediate exposures (noncancer). ATSDR's intermediate MRL for PCB exposure is 0.00003 mg/kg/day, based on a laboratory animal study of monkeys (see Appendix A in ATSDR 2000b). In the study, monkeys were administered PCBs orally three times a day via a syringe to the back of the mouth—a dosing method that is similar to breast-feeding exposure. This dosing started at birth and continued for 20 weeks. The group of monkeys with exposure doses of 0.0075 mg/kg/day, when compared to those that were not dosed with PCBs, were found to have impaired performance on tasks used to test for neurobehavioral toxicity. Therefore, 0.0075 mg/kg/day is reported as a LOAEL for intermediate exposure to PCBs. ATSDR applied an uncertainty factor of 300 to this LOAEL to derive an intermediate MRL of 0.00003 mg/kg/day. Results from other laboratory animal studies have found PCB-related immunologic effects and various clinical manifestations of toxicity (e.g., ocular effects) at similar exposure doses, thus providing some confidence that the LOAEL identified for the MRL study is a reasonable indicator of exposure doses at which toxic effects might be expected to occur in laboratory animals.

Table B-2 compares the estimated ingestion exposures for residents of the four properties near YMR with PCB-contaminated surface soils to the MRLs and LOAELs discussed above. The estimated exposure doses were calculated using the equations cited previously. Inputs to this equation included the highest property-average surface soil concentration of PCBs and ATSDR default exposure factors for body weight (10 kg and 70 kg for children and adults, respectively) and soil ingestion rate (200 mg/day and 100 mg/day for children and adults, respectively). These parameters are believed to offer reasonable accounts of actual ingestion exposures. As Table B-2 shows, the estimated exposure dose for children is less than 4 times lower than the LOAEL for neurobehavioral toxicity, while exposure doses for adults are 75 times lower than this LOAEL. In summary, the estimated exposure levels are lower than the lowest effect levels reported in animal studies; however, because the estimated doses are less than 5 times below these LOAELs, prudent public health practice calls for action to prevent or reduce exposures.

ATSDR acknowledges that this evaluation involves some uncertainty. One possible source of uncertainty is the fact that the dose calculations do not consider the bioavailability of PCBs in soils. Food ingestion studies, however, indicate that the human gastrointestinal tract efficiently absorbs PCBs (ATSDR 2000b). Another source of uncertainty is the quality of the laboratory animal studies and the relevance of these studies to human toxicity. ATSDR scientists and external peer reviewers extensively reviewed the quality of the study; these individuals concluded that the study provides an adequate basis for an MRL. Note, though, that some laboratory studies of animals other than monkeys did not detect neurobehavioral deficits at the doses considered in the MRL; this difference could result from many factors (e.g., different exposure doses, inter-species differences, evaluation of different end points). Regarding the relevance of the study to humans, ATSDR notes that subtle neurobehavioral deficits have been observed in human populations exposed to PCBs (ATSDR 2000b). These human studies have inherent limitations, most notably that they cannot attribute the observed deficits specifically to PCB exposure. However, the consistency between the animal and human studies provides some assurance that this evaluation does not misrepresent the toxicity of PCBs.

Chronic Exposures (noncancer). ATSDR's chronic MRL for PCB exposure is 0.00002 mg/kg/day, and is also based on a laboratory animal study of monkeys (see Appendix A in ATSDR 2000b). In the study, groups of monkeys were administered different dose levels of Aroclor 1254 in capsules orally for 23 months. Several end points related to immunotoxicity were examined. Monkeys at all dose levels were found to have decreased antibody production in responses to challenges of sheep red blood cell antigens, while monkeys in the control group did not have impaired immune responses. Based on this finding, 0.005 mg/kg/day (the lowest dose level) is reported as a LOAEL for chronic exposure to PCBs. ATSDR applied an uncertainty factor of 300 to this LOAEL to derive a chronic MRL of 0.00002 mg/kg/day. Results from other laboratory animal studies have found PCB-related immunologic effects and various clinical manifestations of toxicity (e.g., ocular effects) at similar exposure doses, thus providing some confidence that the LOAEL identified for the MRL study is a reasonable indicator of exposure doses at which toxic effects might be expected to occur in laboratory animals.

Table B-2 compares the estimated ingestion exposures for residents of the four properties near YMR with PCB-contaminated surface soils to the MRLs and LOAELs discussed above. The estimated exposure doses were calculated using the equations cited previously and are believed to offer reasonable accounts of actual ingestion exposures. As Table B-2 shows, the estimated exposure dose for children is less than 3 times lower than the LOAEL for immunotoxicity, while exposure doses for adults are 50 times lower than this LOAEL. Based on this evaluation, it is possible that children who live in the four homes near YMR with PCB-contaminated surface soils might experience immune system effects.

This health effects evaluation does involve uncertainty, primarily that associated with the relevance of the laboratory animal study considered for the MRL. In April 2000, ATSDR convened an expert panel to review the agency's Toxicological Profile for PCBs (see Appendix E in ATSDR 2000b). That panel generally agreed that the immunotoxicity study listed above was well conducted, examined endpoints relevant to humans, and serves an adequate basis for ATSDR's MRL. Further, ATSDR notes that multiple human studies have examined the potential immunotoxicity of PCBs. ATSDR has found that the individual human studies provide limited evidence of PCB immunotoxicity; however, ATSDR concluded that "there is a consistency of effects among the human studies suggesting sensitivity of the immune system to PCBs" (ATSDR 2000b). This consistency between animal and human studies, at least in a general sense, again provides some assurance that this health effects evaluation provides a reasonable account of the chronic toxicity of PCBs.

Cancer Evaluation. PCBs have been found to cause cancer in controlled studies of laboratory animals, but evidence for carcinogenicity in humans is less clear. EPA has concluded that PCBs are "probable human carcinogens," based on sufficient animal studies, but inadequate information in humans. Similarly, the International Agency for Research on Cancer (IARC) has classified PCBs as "probably carcinogenic to humans," based on sufficient evidence from animals and limited human evidence. Finally, the National Toxicology Program (NTP) has found PCBs to be "reasonably anticipated to be a carcinogen."

EPA has published a cancer slope factor for Aroclor 1254. This factor is used to calculate theoretical cancer risks for purposes of identifying sites that require environmental clean-up. Given the limited evidence of carcinogenicity in humans and the magnitude of the theoretical cancer risk, ATSDR concludes that exposure to contaminated surface soils is not expected to cause an increase in cancer outcomes. Clean-up of the contaminated soils (which is recommended due to the possibility that children might experience noncancer outcomes) should effectively reduce PCB-related cancer risks to zero.

ATSDR generally considers that for most exposure scenarios dermal exposure is a minor contributor to the overall exposure dose. If dermal exposures are a particular concern at your site, dermal exposures can be quantitatively evaluated.

Dermal Exposure. Unlike the evaluation for incidental ingestion, dermal contact with soil is not evaluated quantitatively through deriving exposure doses. Rather, this evaluation is a qualitative discussion of the potential for absorption into the body through the skin. Considerable uncertainty exists for quantitatively estimating dermal exposure, especially for contact with soil, because there is very little chemical-specific data available and the predictive techniques have not been well validated (EPA 1992; 2001).

The dermal route of exposure can contribute to the accumulation of PCBs in people. In vitro studies in human cadaver skin indicate that less than 3% of PCBs in soil are retained in human skin and in vivo studies in Rhesus monkeys indicate that 14% of the administered dose was absorbed (ATSDR 2000b). Therefore, dermal exposure to PCBs in the soil can lead to an increase in the overall dose. While the amount of PCBs absorbed through the skin is difficult to quantify, it would be expected to result in a much lower dose than previously discussed in the incidental ingestion pathway because the absorption is less efficient by the dermal route than through ingestion (ATSDR 2000b).

Table B-2. Estimated Exposure Doses to Aroclor 1254 in Surface Soil Compared to Screening Values and Observed Effect Levels

Exposure Situation	***Exposure Concentration***	***Estimated Exposure Dose (mg/kg/day)***		***MRL (mg/kg/day)***	***NOAEL (mg/kg/day)***	***LOAEL (mg/kg/day)***
		Adult	***Child***			
Intermediate	80 ppm	0.0001	0.002	0.00003	NA	0.0075
Chronic	80 ppm	0.0001	0.002	0.00002	NA	0.005

NA = not applicable. The laboratory animal studies selected for MRLs (see Appendix A in ATSDR 2000b) identified LOAELs, but did not identify NOAELs.

Appendix C. Fact Sheets

Petitioned Public Health Assessments

What is ATSDR?

ATSDR is the Agency for Toxic Substances and Disease Registry, a federal public health agency. ATSDR is part of the Public Health Service in the U.S. Department of Health and Human Services. ATSDR is not a regulatory agency like the U.S. Environmental Protection Agency. Created by Superfund legislation in 1980, ATSDR's mission is to prevent exposure and adverse human health effects and diminished quality of life associated with exposure to hazardous substances from waste sites, unplanned releases, and other sources of pollution present in the environment. Through its programs—including surveillance, registries, health studies, environmental health education, and applied substance-specific research—and by working with other federal, state, and local government agencies, ATSDR acts to protect public health.

What is a Public Health Assessment?

An ATSDR Public Health Assessment is not the same thing as a medical exam or a community health study. It can sometimes lead to those things, as well as to other public health activities. ATSDR conducts a Public Health Assessment for every site on or proposed for the National Priorities List (also known as the Superfund list). ATSDR can also be petitioned to conduct a Public Health Assessment for other sites.

A Public Health Assessment reviews information about hazardous substances at a site and evaluates whether exposure to those substances might cause any harm to people. Public Health Assessments consider—

- what the levels (or "concentrations") of hazardous substances are
- whether people might be exposed to contamination and how (through "exposure pathways" such as breathing air, drinking or contacting water, contacting or eating soil, or eating food)
- what harm the substances might cause to people (or the contaminants' "toxicity")
- whether working or living nearby might affect people's health
- other dangers to people, such as unsafe buildings, abandoned mine shafts, or other physical hazards

To make those determinations, ATSDR looks at three primary sources of information—

- *environmental data*, such as information available on the contaminants and how people could come in contact with them
- *health data*, including available information on communitywide rates of illness, disease, and death compared with national and state rates
- *community concerns*, such as reports from the public about how the site affects their health or quality of life

How Can I Petition for a Public Health Assessment?

The petition process is very simple. All you have to do is write to:

Assistant Administrator, ATSDR (CHB)
1600 Clifton Road, NE (E28)
Atlanta, GA 30333

In your letter, you must include the following information:

- your name, address, and phone number
- the name of the group you represent, if any
- the name, location, and description of the facility or release
- information you have about people's exposure to a toxic substance
- a request that ATSDR perform a Public Health Assessment

This information is also helpful to ATSDR, but not required:

- any other information you can provide about the facility or release—such as the chemical you are concerned about, the amount in the environment now or in the past, or the parties you believe may be responsible
- exposure pathways
- how many people might be exposed—particularly how many older persons and children
- other government agencies you have contacted or which have investigated already

What Happens After ATSDR Gets My Petition?

When ATSDR receives a petition, a team of environmental scientists, physicians, toxicologists, and other staff members is assigned to work on it. This team begins to gather information about the site. Team members visit the site to see it firsthand and to talk with the community. After that, the team evaluates all site information and presents the results to the ATSDR petition committee. That committee decides whether ATSDR will perform a Public Health Assessment or if some other action—such as a Public Health Advisory or Health Consultation or community environmental health education—would better meet the community's needs, or if no action is needed. Petitioners are informed in writing of ATSDR's decision and the reasons for it.

Fact sheets are available on Public Health Advisories, Health Consultations, and other ATSDR activities. If you want to know more about ATSDR, or if you have health concerns about a site or information to share about ways people might have been or might now be exposed to hazardous substances, please contact the ATSDR Community Involvement Team, visit the ATSDR web site, or call the ATSDR toll-free information line.

Community Involvement Team
ATSDR - Division of Health Assessment and Consultation
1600 Clifton Road, NE (E56)
Atlanta, Georgia 30333

ATSDR web site at http://atsdr1.atsdr.cdc.gov:8080/

ATSDR information line (888) 42-ATSDR, that's (888) 422-8737

January 1999

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ARSENIC
CAS # 7440-38-2

Division of Toxicology ToxFAQs™ **December 2003**

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to higher than average levels of arsenic occurs mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found at 1,014 of the 1,598 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Organic arsenic compounds are used as pesticides, primarily on cotton plants.

What happens to arsenic when it enters the environment?

- Arsenic cannot be destroyed in the environment. It can only change its form.
- Arsenic in air will settle to the ground or is washed out of the air by rain.
- Many arsenic compounds can dissolve in water.
- Fish and shellfish can accumulate arsenic, but the arsenic in fish is mostly in a form that is not harmful.

How might I be exposed to arsenic?

- Eating food, drinking water, or breathing air containing arsenic.
- Breathing contaminated workplace air.
- Breathing sawdust or burning smoke from wood treated with arsenic.
- Living near uncontrolled hazardous waste sites containing arsenic.
- Living in areas with unusually high natural levels of arsenic in rock.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs. Ingesting high levels of inorganic arsenic can result in death. Lower levels of arsenic can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

Organic arsenic compounds are less toxic than inorganic arsenic compounds. Exposure to high levels of some organic arsenic compounds may cause similar effects as inorganic arsenic.

How likely is arsenic to cause cancer?

Several studies have shown that inorganic arsenic can increase the risk of lung cancer, skin cancer, bladder cancer, liver cancer, kidney cancer, and prostate cancer. The World Health Organization (WHO), the Department of Health and Human Services (DHHS), and the EPA have determined that inorganic arsenic is a human carcinogen.

How can arsenic affect children?

We do not know if exposure to arsenic will result in birth defects or other developmental effects in people. Birth defects have been observed in animals exposed to inorganic arsenic.

It is likely that health effects seen in children exposed to high amounts of arsenic will be similar to the effects seen in adults.

How can families reduce the risk of exposure to arsenic?

❑ If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.
❑ If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.

Is there a medical test to show whether I've been exposed to arsenic?

There are tests to measure the level of arsenic in blood, urine, hair, or fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels or arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict how the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or canceled many uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration has set limits of 10 μg arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

Source of Information

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Arsenic. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

POLYCHLORINATED BIPHENYLS

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about polychlorinated biphenyls. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polychlorinated biphenyls?

Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils.

What happens to PCBs when they enter the environment?

❏ PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.
❏ PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.
❏ PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.
❏ PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

How might I be exposed to PCBs?

❏ Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.
❏ Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.
❏ Breathing air near hazardous waste sites and drinking contaminated well water.
❏ In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

How can PCBs affect my health?

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

How likely are PCBs to cause cancer?

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. The EPA and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans.

How can PCBs affect children?

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

How can families reduce the risk of exposure to PCBs?

❑ You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.

❑ Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.

❑ Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.

❑ If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

Is there a medical test to show whether I've been exposed to PCBs?

Tests exist to measure levels of PCBs in your blood, body fat, and breast milk, but these are not routinely conducted. Most people normally have low levels of PCBs in their body because nearly everyone has been environmentally exposed to PCBs. The tests can show if your PCB levels are elevated, which would indicate past exposure to above-normal levels of PCBs, but cannot determine when or how long you were exposed or whether you will develop health effects.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA. The Food and Drug Administration (FDA) requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological profile for polychlorinated biphenyls (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.